

*Suffolk County Vector Control  
and Wetlands Management Long-Term Plan  
and Generic Environmental Impact Statement  
Task 12*

*For the:*

**Wertheim National Wildlife Refuge  
Water Management Demonstration Project  
Data Report and Summary 2003-2008**



**October 2009**

Suffolk County Department of Environment and Energy  
Suffolk County Department of Public Works  
Suffolk County Department of Health Services

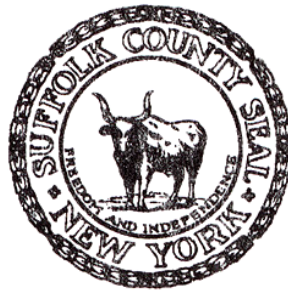
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**SUFFOLK COUNTY VECTOR CONTROL AND WETLANDS MANAGEMENT  
LONG - TERM PLAN AND ENVIRONMENTAL IMPACT STATEMENT**

**PROJECT SPONSOR**

**Steve Levy**  
**Suffolk County Executive**



**Department of Environment and Energy**

Carrie Meek Gallagher  
*Commissioner*

**Department of Public Works**

Gilbert Anderson, P.E.  
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Thomas LaGuardia  
*Chief Deputy Commissioner*  
Louis Calderone  
*Deputy Commissioner*

**Department of Health Services**

Humayun J. Chaudhry, D.O., M.S.  
*Commissioner*  
Vito Minei, P.E.  
*Director, Division of Environmental Quality*  
Walter Dawydiak, P.E., J.D.  
*Chief Engineer, Division of Environmental Quality*

**PROJECT MANAGEMENT**

Project Manager: Dominick V. Ninivaggi  
Superintendent, Suffolk County Department of Public Works, Division of Vector Control

**Suffolk County Department of Public  
Works, Division of Vector Control**

Tom Iwanejko  
*Principal Environmental Analyst*  
Ilia Rochlin  
*Entomologist*

**Suffolk County Department of  
Health Services, Office of Ecology**

Martin Trent  
*Chief of the Office of Ecology*  
Kimberly Shaw  
*Bureau Supervisor*

**Suffolk County Department of  
Environment and Energy**

Mary E. Dempsey  
*Biologist*  
Jeanine Schlosser  
*Head Clerk*

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# WERTHEIM NATIONAL WILDLIFE REFUGE WATER MANAGEMENT DEMONSTRATION PROJECT DATA REPORT AND SUMMARY 2003-2008

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**LIST OF ABBREVIATIONS AND ACRONYMS**

BACI	Before-After-Control-Impact
GIS	Geographic Information Systems
GPS	Global Positioning System
NYSDEC	New York State Department of Environmental Conservation
OMWM	Open Marsh Water Management
PDA	Personal Digital Assistant
SCDHS	Suffolk County Department of Health Services
SCVC	Suffolk County Department of Public Works, Division of Vector Control
USACE	United States Army Corps of Engineers
USFWS	US Fish and Wildlife Service

## **ABSTRACT**

This report represents a continuation of the monitoring program for the Wertheim National Wildlife Refuge (WNWR) Water Management Demonstration Project ("Wertheim Project"). The project was initiated in 2003 as part of the Suffolk County Vector Control and Wetlands Management Long-Term Plan. The study area is part of a tidal wetland complex that consists primarily of high marsh, intertidal marsh and associated freshwater wetlands and tidal creeks. These wetlands had been ditched for mosquito control in the 1930's, with some of the ditches later being plugged as part of earlier restoration efforts. The project was intended to limit or reverse the impacts of ditching and invasion of the marsh by *Phragmites* while also reducing or eliminating the need to apply pesticides to control mosquito larvae. The marsh alterations included filling of mosquito ditches, creation of tidal channels, creation of shallow tidal connectors, creation of marsh ponds and deposition of excess marsh soil in a thin layer on the marsh surface ("back-blading"). Many of these techniques have been used in other settings as part of Open Marsh Water Management (OMWM) to control mosquitoes, but the primary purpose of this project was to demonstrate the use of these techniques to restore natural resource values in a ditched wetland. The study design involves two managed areas (Areas 1 and 2) and two reference or "control" sites (Areas 3 and 4) and a Before-After-Control-Impact (BACI) design. The monitoring program has been in place for 5 years, with 4 years of post-project data for Area 1 and 3 years of post-project data for Area 2. The information collected to this point indicates that typical marsh habitats and native flora and fauna have replaced the ditched marsh and some of the *Phragmites* in the managed areas, and that the need for pesticides to control mosquitoes has been drastically reduced. The reference habitats have exhibited little change, indicating that the observed changes in the managed areas are the result of the management efforts. This report includes a new, geospatial analysis of the mosquito larval data designed to improve understanding of the effects of the management on the distribution of the larvae in time and space.

## **EXECUTIVE SUMMARY**

### ***Introduction***

The Wertheim National Wildlife Refuge Water Management Demonstration Project is a joint project between the US Fish and Wildlife Service and Suffolk County. The overarching goals of the project have included the following: 1) to reduce mosquito production and pesticide usage by employing Open Marsh Water Management (OMWM) techniques, 2) to maintain or enhance fish and wildlife biodiversity and habitat, 3) to achieve acceptable ecological marsh function as measured by wetlands plant succession, and 4) to reduce the vigor and extent of the invasive reed *Phragmites australis*.

Four areas were delineated for the project to utilize before-after-control-impact (BACI) design, which allows comprehensive statistical assessment of the project outcome. Two treatment areas, Areas 1 and 2, were the impact locations subjected to OMWM (ponds and connectors), marsh surface restoration (filling in mosquito ditches), and *Phragmites* control (tidal channels). Area 1 was treated in March 2005, and Area 2 was treated in February/March 2006. Two control areas, Areas 3 and 4, were not modified and retained parallel grid ditches. All 4 areas were monitored before and after the modifications in the treatment Areas 1 and 2 had been carried out.

The project evaluation consisted of monitoring physical, chemical, and biological parameters. For 2008, the physical parameters included marsh water table height; the chemical parameters included pore water salinity; and the biological monitoring included marsh vegetation, mosquitoes, nekton, and birds. For 2008 report, the analysis focused on 2008 data for all parameters with the exception of mosquito larval data, which were assessed over the study period from 2004 through 2008.

### ***Water Table Height***

Salt marsh water table height was measured eleven times from May through October of 2008 and compared to determine the effects of treatment, area, and each sampling station. The treatment effect on water table level was not statistically significant, and no significant differences were found among the four areas suggesting no impact of marsh alteration on water table height in 2008.



### ***Pore Water Salinity***

Pore water salinity was measured eleven times from May through October of 2008 and compared to determine the effects of treatment, area, and each sampling station. The treatment effect was not statistically significant, however, there were significant differences among the four areas. Pore water salinity in Area 1 was significantly lower compared to other areas, followed by pore water salinity in Area 4. Areas 2 and 3 had the highest pore water salinities, which were similar to each other. These findings suggest that in 2008 marsh alteration had no impact on pore water salinity, which varied depending on other factors such as upland location (Area 1) or significant freshwater input (Area 4).

### ***Marsh Vegetation***

The marsh vegetation was sampled by 4 different methods each conducted once in 2008: quadrat sampling, biomass sampling, marsh vegetation composition (aerial photography ground-truthing), and surface photography. Vegetation quadrat sampling quantifies plant species community at 88 sampling stations throughout the 4 areas. Plant community composition was compared between treatments and among the four areas. Plant community composition was similar between treatment and control marshes, but differed among the four areas with Area 1 significantly different from the remaining three areas, which were similar to each other. Six plant species contributed approximately 70% of the observed dissimilarity between Area 1 and Areas 2-4. *Spartina alterniflora* (smooth cordgrass) had smaller percent cover, while *Schoenoplectus pungens* (common threesquare), *Spartina patens* (salt hay), *Distichlis spicata* (spike grass), *Schoenoplectus robustus* (sturdy bulrush), and *Solidago sempervirens* (seaside goldenrod) had larger percent cover in Area 1 compared to all other areas. In addition, Area 1 had a larger percent cover by dead *Phragmites* compared to all other areas, and smaller percent cover by live *Phragmites* compared to Areas 3 and 4. These findings suggest that Area 1 had smaller percent cover by low marsh vegetation (*i.e.*, smooth cordgrass) and larger percent cover by high marsh vegetation (other plant species). High marsh vegetation in Area 1 was also more diverse compared to other areas.

Vegetation biomass was sampled at either 44 (above ground) or 22 (below ground) stations and compared between treatment type and among the four areas. For above ground biomass, the

treatment areas (Areas 1 and 2) had significantly higher total biomass compared to the control areas (Areas 3 and 4). More live biomass was found in the treatment Areas 1 and 2 compared to the control Areas 3 and 4, whereas the proportion of dead biomass was similar among the 4 areas. In addition, the treatment Areas 1 and 2 had significantly higher below-ground biomass compared to the control Areas 3 and 4. These findings suggest that marsh alteration had a significant positive impact on vegetation biomass in 2008.

Marsh vegetation composition was assessed by ground-truthing aerial photography to create 2008 vegetation maps for qualitative trend analysis. The 2008 maps showed a decrease in the extent of *Phragmites* in Area 1 and a higher percentage of the mix of high and low marsh vegetation in Area 2 compared to those in 2007. Both Areas 3 and 4 were subjected to *Phragmites* removal by USWFS using herbicides and physical alterations such as mowing in 2007-2008. Accordingly, the map of Area 3 showed both the removal of *Phragmites* and the re-appearance of high marsh vegetation in the northern portion of the area. The map of Area 4 showed very extensive *Phragmites* removal by physical means.

Marsh vegetation photographs taken at the surface level to visually document the status of marsh vegetation were taken at 29 permanent photo-stations and are attached to this report.

### ***Mosquito Larvae***

Mosquito larvae sampling was conducted by monthly transect sampling at 88 stations and by weekly targeted sampling. The mosquito data were analyzed for the entire study the period from 2004-2008 using a combination of parametric statistics and geostatistical methods. The frequency of finding mosquito larvae in the treatment areas (Areas 1 and 2) was reduced by ~70% resulting in a loss of spatial larval clusters compared to those found in the control areas (Areas 3 and 4), which remained virtually unchanged throughout the project. This effect was observed directly following OMWM treatment and remained significant throughout the study period. The greatly reduced frequency of finding larvae in the treatment Areas 1 and 2 led to a significant decrease (~44%) in the number of times when the larviciding threshold was reached in the treatment areas. This reduction, in turn, resulted in a significant decrease (~74%) in the number of larvicide applications in the treatment areas (Area 1 and 2) post-modification. The

remaining larval habitat in the treatment areas had a different geographic distribution and was largely confined to the restored marsh surface (*i.e.*, filled-in mosquito ditches); however only approximately one-fifth of the restored marsh surface supported mosquito production.

The treatment Areas 1 and 2 consistently received significantly fewer larvicide applications during the post-modification period. The differences attributable to OMWM were not only detectable, but statistically significant despite the confounding effect of continuing larvicide applications in control areas. Control areas supported higher mosquito production despite retaining intact grid ditching and being subjected to 3-4 times more larvicide applications than did the treatment areas post-modification. Thus, the OMWM component demonstrated its potential to largely replace chemical control and marsh-wide parallel grid ditching for effective larval mosquito control in the context of integrated marsh management including marsh restoration and invasive species control.

### ***Nekton***

Nekton (fish and shrimp) was collected three times in 2008 and compared to determine the effects of treatment, area, and each sampling station. Four different parameters were used for the analysis: average density, species richness, size of dominant nekton, and community composition.

Nekton density (*i.e.*, abundance) did not differ statistically between the treatment (Areas 1 and 2) and the control (Areas 3 and 4), as well as among the four areas. This finding suggests that in 2008 there was no evident impact on nekton abundance due to marsh alterations.

Species richness in the treatment Areas 1 and 2 was significantly higher than that in the control Areas 3 and 4, whereas the area effect was not statistically significant. This finding suggests that marsh alteration had a positive impact on nekton species composition in 2008.

Two dominant (*i.e.*, the most abundant) species were selected for body size determination: *Fundulus heteroclitus* (mummichog) and *Cyprinodon variegatus* (sheepshead minnow) represented approximately 63% and 15% of the total collected in 2008. For both species,

treatment and area effects were not statistically significant, whereas the sampling station effect was significant. Therefore, the variability among different stations was greater than the variability among different areas or between the treatment and the control. This finding suggests that in 2008 there was no impact on dominant nekton body size by marsh modification

Nekton community did not differ between the treatment and the control marshes or among the four areas. *F. heteroclitus* (mummichog) predominated in all areas with no statistically significant differences among the four areas. The second most abundant nekton species, *C. variegatus* (sheepshead minnow), was not found in Area 4. Other nekton species were better represented in one or two areas, e.g. *Menidia* spp. (silversides) in Area 2, *Palaemonetes* spp. (marsh shrimp) in Areas 2 and 3, and *F. luciae* (rainwater killifish) in Area 4. These findings suggest that marsh modification did not have an impact on nekton community composition in 2008.

### ***Birds***

In 2008, the surveys of the bird population were conducted once in the winter and three times in the summer. Avian data were analyzed by guild (a group of species that occupy similar ecological niche) using average guild density and average guild percent composition per sampling station.

In terms of guild density, the guild community did not differ among the areas or between the treatment and the control marshes. In terms of guild percent composition, the guild community did not differ among the areas or between the treatment and the control marshes. There was a significant difference between the seasons, winter versus summer, with ~46% of the difference accounted for by higher Passerine guild abundance during summer.

These findings suggest that there was no impact of marsh modification on bird guild density or relative abundance in 2008.

## ***Discussion***

The project has dramatically reduced the spatial extent and frequency of finding mosquito larvae in the managed areas resulting in a significant decrease in mosquito production and number of required larvicide applications compared to reference areas.

Ecological function as measured by water table height, soil salinity and measures of plant community biomass, production and species composition were all either similar in the managed versus reference area or were improved by the marsh alterations. The managed areas were revegetated with a diverse array of native, high marsh plants. Live biomass was higher in the managed areas versus the reference sites. The higher below-ground biomass in the managed areas is especially worth noting, since this is the portion of the plants that survives from year to year and helps stabilize the marsh surface.

In terms of fish and wildlife habitat and diversity, the managed areas clearly support populations and diversity equal or superior to the reference areas. The main statistical difference between the managed and reference areas was an increase in nekton species richness in the managed areas.

The extent of *Phragmites* has been reduced in the managed areas, also in keeping with project goals. This aspect of the project will become more difficult to evaluate in the future, since USFWS has initiated a program of *Phragmites* control on the Refuge (including all four project areas) utilizing herbicides and physical removal of the dead stalks.

In summary, the project appears to be meeting its goals to this point, the immediate post-construction phase. Further monitoring will take place to evaluate whether these changes are sustained over time. The lessons learned in the course of this project should be considered in future projects of this kind in Suffolk County.



### **AUTHORS NOTE**

Monitoring for the 2008 Wertheim Water Management Demonstration Project Report was conducted by Mary Dempsey (Suffolk County Department of Environment and Energy), Dominick Ninivaggi, Tom Iwanejko, and Ilia Rochlin (Suffolk County Department of Public Works, Division of Vector Control), and Alex Chmielweski, Azucena Ponce, and Andy Hinickle (USFWS). Data analysis and report writing were carried out by Ilia Rochlin, Tom Iwanejko, Mary Dempsey, and Dominick Ninivaggi. The report was reviewed by Dominick Ninivaggi (Suffolk County Department of Public Works, Division of Vector Control), Walter Dawydiak, P.E., J.D and Kim Shaw (Suffolk County Department of Health Services), Suffolk County Department of Environment and Energy, and Michelle Williams (USFWS).

New York State Department of Environmental Conservation (NYSDEC) permit number 1-4722-00392/00038 requires that an annual report of monitoring efforts, data, and analysis is produced. Previous data reports were submitted to NYSDEC for: Year 1 (2003), Year 2 (2003- 2004), Year 3 (2003-2005), Year 4 (2003-2006), and Year 5 (2003-2007).

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We are indebted to Dr. Mary Jane James-Pirri (University of Rhode Island) for generous assistance and support with statistical analysis and interpretation.

## 1.0 Introduction

Wertheim National Wildlife Refuge (WNWR) Water Management Demonstration Project ("Wertheim Project") was initiated in 2003 as part of the Suffolk County Vector Control and Wetlands Management Long-Term Plan. This integrated marsh management project was designed to include two components – Open Marsh Water Management (OMWM) and marsh restoration. The OMWM component aimed to decrease pesticide usage for mosquito control by reducing the number of mosquito breeding sites, reduce the frequency of mosquito breeding, and to effectively control mosquito populations through biological control by native fish. The marsh restoration component aimed to maintain or enhance biological diversity, avian biodiversity, and fish habitat values; to reduce the vigor and extent of the invasive plant species *Phragmites australis*; and to achieve acceptable ecological function (as measured by wetlands plants succession). The overarching goal of the Wertheim Project was to demonstrate that mosquito management techniques such as OMWM are compatible with the U.S. Fish and Wildlife Service (USFWS) mandate of protecting, preserving, and enhancing fish and wildlife habitat. USFWS also requested that the project restore natural salt marsh features including tidal creeks and ponds while removing many of the long, linear mosquito ditches. Wertheim Project locations are along the east bank of the Carmans River, near its confluence with Bellport Bay, which is part of the Great South Bay. Four areas were delineated for the project (Figure 1-1). Areas 1 and 2 are the treatment areas where marsh alternations took place in 2005 (Area 1) and 2006 (Area 2). Areas 3 and 4 serve as the control areas where no marsh modification has occurred. USFWS serves as the lead agency on the permit to conduct the water-management practices at WNWR. New York State Department of Environmental Conservation (NYSDEC) Article 25 Tidal Wetlands permit and a United States Army Corps of Engineers (USACOE) Nationwide General Permit Number 27 were procured prior to the Wertheim Project's commencement. The NYSDEC permit is valid for ten (10) years (January 10, 2005 – January 10, 2015). The monitoring protocol includes physical, chemical, and biological parameters measured before and after the marsh alteration and will be carried out during the 10-year NYSDEC permit period. The 2008 summary of monitoring activities including locations, frequency, and sampling methods is listed in Table 1-1. This data report focuses on analyzing the data collected in 2008, which is the 4<sup>th</sup> year post-construction in Area 1, and the 3<sup>rd</sup> year post-construction in Area 2.



Figure 1-1. Water Management Demonstration Project  
Locations at the Wertheim National Wildlife Refuge

**Table 1-1. Wertheim Project Sampling Parameters, 2008**

Parameter	Sample Location	Frequency	Methods
<i>Physical Parameters Sampling</i>			
Salt Marsh Water Table Height	All transect stations (88 stations total)	May through October Bi-monthly	2 inch above-ground PVC well at each station (USFWS/USGS protocols)
<i>Chemical Parameters Sampling</i>			
Pore Water Salinity	All transect stations (88 stations total)	May through October Bi-monthly	Soil probe and refractometer (USFWS/USGS protocols)
Water Quality parameters (Dissolved Oxygen, Salinity, Temperature)	All four areas (39 fish stations total)	Spring, Summer, Fall	YSI meter
<i>Biological Parameters Sampling</i>			
Mosquito Larval Sampling	All transect stations (88 stations total)	May through September	Transects: Samples taken every 15-20 meters along each transect (USFWS/USGS protocols)
Transects	Areas of standing water throughout marsh	Transects: Monthly	Targeted: Traverse marsh & visually inspect pools and pannes
Targeted		Targeted: Weekly	
Vegetation Quadrat	All transect stations (88 stations total)	Annually (towards the end of growing season)	Point intercept method (50 point grid for speciation) (USFWS/USGS protocols)
Vegetation Biomass	Surface clip (approximately 50% of transect stations, 44 stations)  Soil core (25% of transect stations, 22 stations)	Annually (towards the end of growing season)	Root & stalk within dried mass
Vegetation Marsh Composition	All four areas	Annually (towards the end of growing season)	Ground-truth aerial photographs

Parameter	Sample Location	Frequency	Methods
Vegetation Photo Documentation	All four areas (30, 29 [2008] photo stations total)	Annually in September	Set photo stations in each area, North, South, East, West direction at all sites. NYS Guidelines: permanent fixed photo stations, 2 photos per station
Nekton Sampling	All four areas (39 fish stations total)	Spring, Summer, Fall	Ditch nets and throw traps (USFWS/USGS protocols)
Bird Surveys	All four areas (17 bird stations total)	Three times in summer, once in winter for a total of 4 times per year	Fixed points for bird stations (50 meter radius) and walking route (Shriver, 2000) conducted from sunrise to 11am.

Annual Wertheim Project Reports for 2003-2007, including yearly summaries and all data collected from previous years sampling efforts are available from Suffolk County's website: <http://www.suffolkcountyny.gov/health/suffolkvectorplan/>

### 1.1 Project Background

Pre-treatment monitoring began in 2003 to establish a "Before-After/Control-Impact" (BACI) design paradigm. BACI, along with associated statistical tests, is the basis for determining the impacts of the treatment on Areas 1 and 2. The location of the proposed alterations was identified by aerial photographs, mosquito breeding site maps, and topographic survey, with elevations. The ponds were placed in low-lying areas, which are near actual and potential breeding sites.

### 1.2 Project Goals

Wertheim is managed by USFWS. The latter agency works to maintain, and enhance, habitat, wildlife diversity, and productivity. USFWS is dedicated to protecting the Carmans River estuary for use by migratory waterfowl and other waterbirds. Its mission is to "administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future



generations of Americans". USFWS follows an interim guidance for mosquito management on National Wildlife Refuges. Its draft policy declares that "we will allow populations of native mosquito species to function unimpeded unless they cause a human and/or wildlife health threat. While we recognize mosquitoes are a natural component of most wetland ecosystems, we also recognize they may represent a threat to human and/or wildlife health. We may allow management of mosquito populations on Refuge System lands when those populations pose a threat to the health and safety of the public or a wildlife population". In recognition of this mandate, Suffolk County is interested in reducing the mosquito larval population. It has been determined that this goal can be accomplished by various means, in particular, naturally by creating access to the larval-breeding sites for fish predation. Features, such as tidal ponds, allow predatory fish access to developing mosquito larvae, attract migratory wading and shorebirds for resting and foraging, and increase salinity in the marsh to control the spread of the invasive *Phragmites australis* (Phragmites), all at the same time.

### **1.3 Description of Project Site, Wertheim National Wildlife Refuge**

WNWR is a 2,572-acre site, situated on the South Shore of Long Island, on the east and west sides of the lower part of the Carmans River, in Shirley, Town of Brookhaven, New York. The Carmans River, one of Long Island's largest rivers, enters from the north, meanders through the refuge, and empties into Bellport Bay, at the southern end of WNWR. Bellport Bay serves as a tidal reference station for the Refuge. The tidal range of Bellport Bay is quite low, at approximately -0.14 feet MLW to 1.10 feet MHW. Within WNWR, the freshwater of the Carmans River mixes with the saltwater of the Bay, forming a critical area for wildlife. This environment supports a remarkable diversity and abundance of aquatic and wildlife species throughout the year. In addition, WNWR provides suitable habitat for several NYS and Federally listed endangered and threatened species. WNWR is a relatively flat area with very little change in elevation between the Carmans and the upland area. Approximately half of the Refuge consists of aquatic habitats including marine waters with seagrass beds, intertidal salt marsh, high salt marsh, freshwater marsh, shrub swamp, and red maple swamp.

#### **1.4. Applicable Relevant Laws and Regulations**

The lower part of the Carmans River has been designated under NYS law as a "Wild and Scenic River" under NYS Wild, Scenic and Recreational Rivers Act, ESL Article 15, Title 27. This law was enacted to encourage preservation and restoration of natural scenic and recreational qualities. The project site is located in a Coastal Management area, and subject to the Waterfront Revitalization and Coastal Resources Act. All lands within the Wertheim National Wildlife Refuge are federally excluded from the New York coastal area. The New York State Department of State (DOS) is in charge of state consistency regulations. DOS reviewed the plan for Wertheim and determined that the activities are consistent with the State's coastal policies. There is no issue about consistency with a Coastal Local Waterfront Revitalization Program (LWRP) since the Town of Brookhaven does not have a state-approved LWRP.

The Carmans River has been designated as a Significant Coastal Fish and Wildlife Habitat (SCFWH), which entails evaluation by DEC and designation by the DOS. But all lands within the Wertheim National Wildlife Refuge are federally excluded from the New York coastal area. Activities associated with restoration, enhancement, or establishment of wetland areas, where the activities result in net increase in aquatic resource functions and services, are covered under the ACOE Nationwide Permit 27. In order for USACOE to issue its permit, it consults with the National Marine Fisheries Service (NOAA Fisheries), relative to projects in areas designated as Essential Fish Habitat (EFH). This assessment of such an EFH for the WNWR Water Management Project conformed to the 1996 amendments to the Magnuson-Stevens Fishery Management and Conservation Act (see FR 62, 244, December 19, 1997). Activities on, or near, the Carmans River require an EFH Assessment for the Northeast Fishery Council's Coastal Pelagics and Northeast Groundfish Management Plans. The Assessment in this case concluded that this project would have little or no impact on any of the important marine and anadromous species located in the EFH. No adverse effect on any of the fish species was found upon evaluation of the project's activities. NOAA fisheries approved the Assessment's findings.

After the project was underway, USFWS completed its Comprehensive Conservation Plan (CCP), which was approved in August, 2006. The CCP provides long-term guidance for management of its Refuges and outlines goals, objectives and strategies to achieve its purposes.

The stated goals are listed, and include, among others, the improvement of the biological diversity and integrity of upland cover types to sustain high quality habitat for migratory passerine birds. One objective under this goal is to *"Restore and enhance bird populations"*. Another stated goal is to restore the biological health of aquatic habitats to high-quality conditions on the Refuge salt marshes, bays, and tidal areas. Under this goal, the stated objective includes the reduction of *Phragmites*, enhancement of *"habitat conditions for salt marsh sharp-tailed sparrow and seaside sparrow"*, a reduction in *"insecticide use in marsh communities"*, and *"Shoreline restoration"*.

## **2.0 Project Design**

OMWM techniques were initially developed in New Jersey in the late 1960s (Ferrigno & Jobbins, 1968; Ferrigno, MacNamara, & Jobbins, 1969). Other projects have been, and continue to be, undertaken in other wetland areas along the northeastern and mid-Atlantic regions of the United States (reviewed by (Wolfe, 1996)). OMWM projects have been previously conducted in Suffolk County in the early 1980s, specifically at Seatuck National Wildlife Refuge. This OMWM pilot study at Seatuck NWR was conducted from 1984 till 1987, with the Final Report published in October, 1990. Seatuck is a one-hundred and ninety six acre refuge located in Islip. The Seatuck OMWM project area covers approximately forty-nine acres of this Refuge. The Wertheim water management project incorporates OMWM design elements that have been used before, though in a larger scale than has ever been conducted before in Suffolk County. The total acreage of the Wertheim project's site, including two treatment and two control sites, comprises approximately one hundred and fifty-seven acres.

In Areas 1 and 2, twenty-three tidal ponds with associated tidal channels and sills were created. These ponds cover approximately 2.8 acres in a total area of eighty-seven (87) acres of these two

treatment sites. In addition, nineteen existing ditches were filled with the materials dug out of the ponds. The materials from these ponds also served to level mosquito-breeding depressions.

The project was designed with specifications for the ponds, whereby they serve as fish reservoirs and bird habitat. The sizes of these ponds are recommended at a minimum of two-hundred square feet, in surface area, and two feet, in depth, except where a narrower one is suggested for certain ditches. This sizing method provides a refuge for fish during low tides. There should be ten feet of slope on at least one side, and a 3/1 slope, with feathered edges. A pond of various depths, and irregularly shaped, allows fish to survive in the deeper portions. At a deeper depth, it is considered too deep for predation by wading birds. See Figure 2-1.

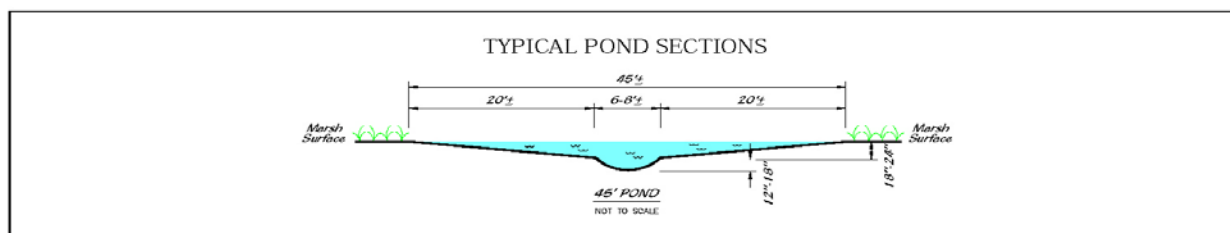


Figure 2-1. Pond Sectional

Shallow, spur sills connected to the ponds were approximately six inches, deep, and six inches, wide. Such depth is adequate to allow fish access, and prevent these spurs from drying out. Tidal channels were cut approximately thirty-six inches, deep, and thirty-six inches, wide. Tidal channels and shallow spur sills were designed with specifications that are outlined in Figure 2-2.

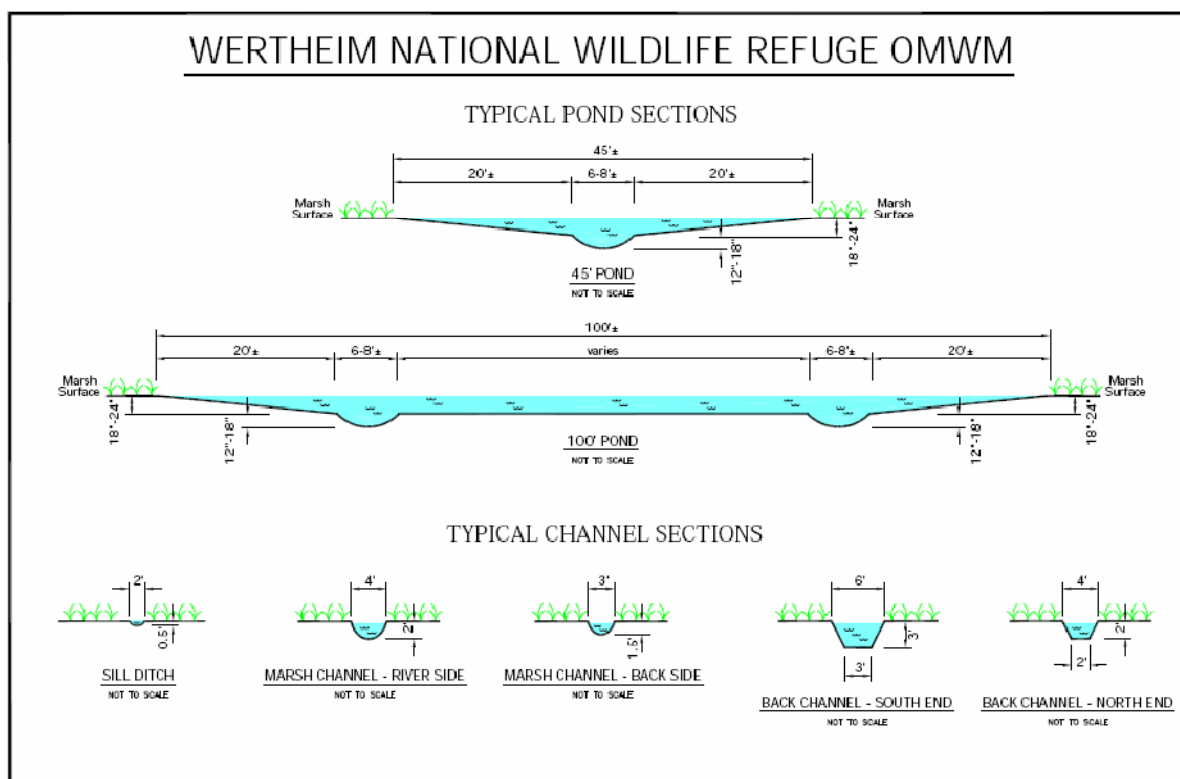


Figure 2-2. Tidal Channel Sections and Sill Sections

Transects were identified across each Area, using USFWS/USGS protocols (James-Pirri, Erwin, & Prosser, 2008). Twenty-four stations were established in each of Areas 1 and 2, and twenty stations were established in Areas 3 and 4, for a total of eighty-eight marsh surface stations. Ten nekton sampling stations ("fish stations") were established per Area in ditches, again using USFWS/USGS protocols.

## 2.1 Area 1

Area 1 is approximately forty acres. This area was treated from approximately March 1, 2005 through March 30, 2005. This treatment area has a dryer marsh surface than Area 2, the other treated site. It also has more freshwater input than Area 2. As a result, Area 1 has greater coverage of *Phragmites* than Area 2. In the spring, Area 1 floods, resulting in approximately two feet of water on the marsh. The original Area 1 nekton sampling stations and the transect stations which remained intact after the construction area shown in Figure 2-3. Mosquito larvae (transects), pore water salinity, water table heights, and

vegetation quadrat were measured at the transect locations. The placement of the project's elements, ponds, tidal creeks or channels, sills, filled ditches, and backbladed areas are shown in Figure 2-4. In this Figure, the inclusions of targeted mosquito larval locations indicate the reason for the placements of these elements. Some of the filled ditches precluded some nekton sampling locations. In addition, the new ponds also provided opportunities for nekton sampling. The locations of the current nekton sampling stations and transects are shown in Figure 2.5.

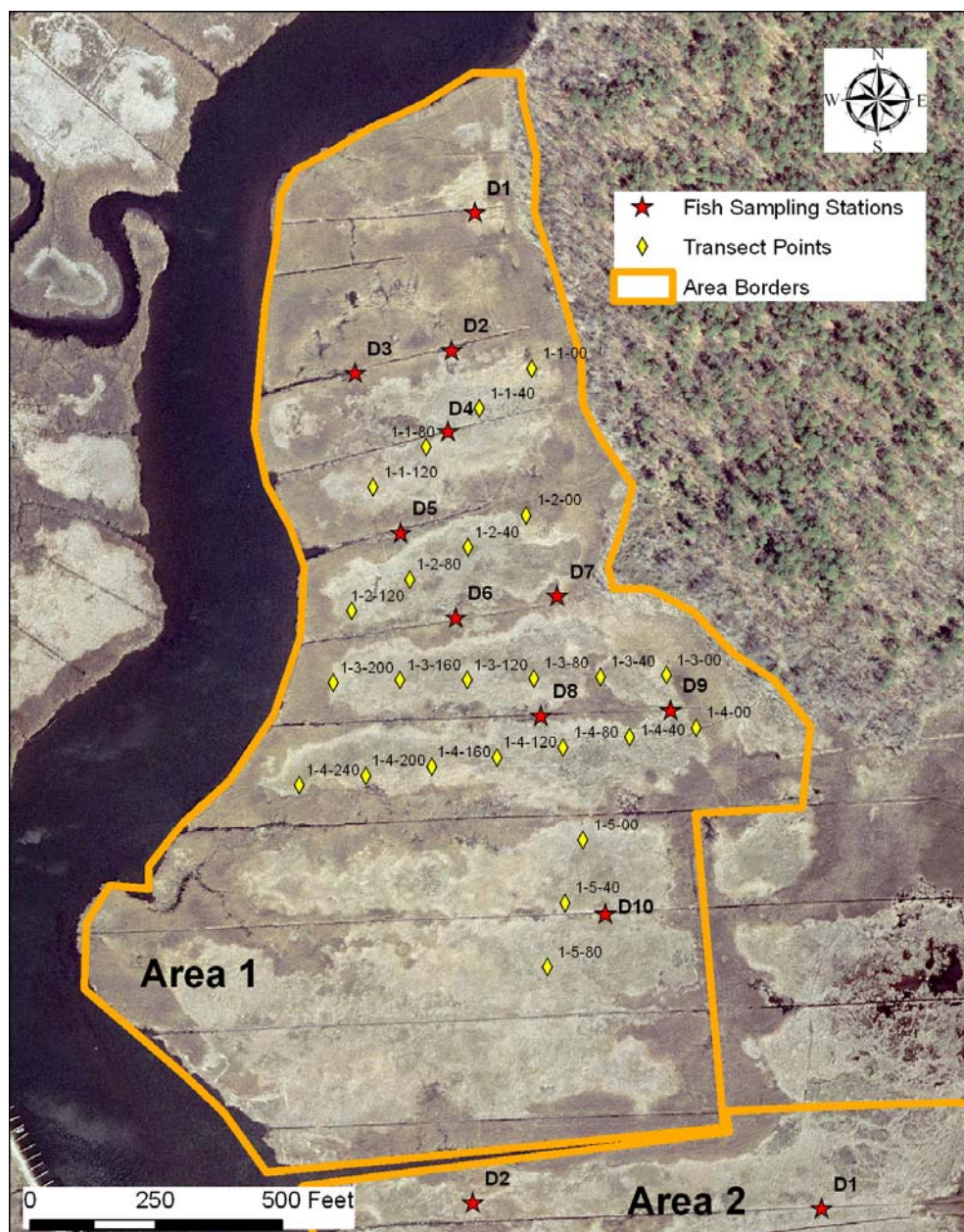


Figure 2-3. Area 1 Sampling Stations, Pre-Treatment



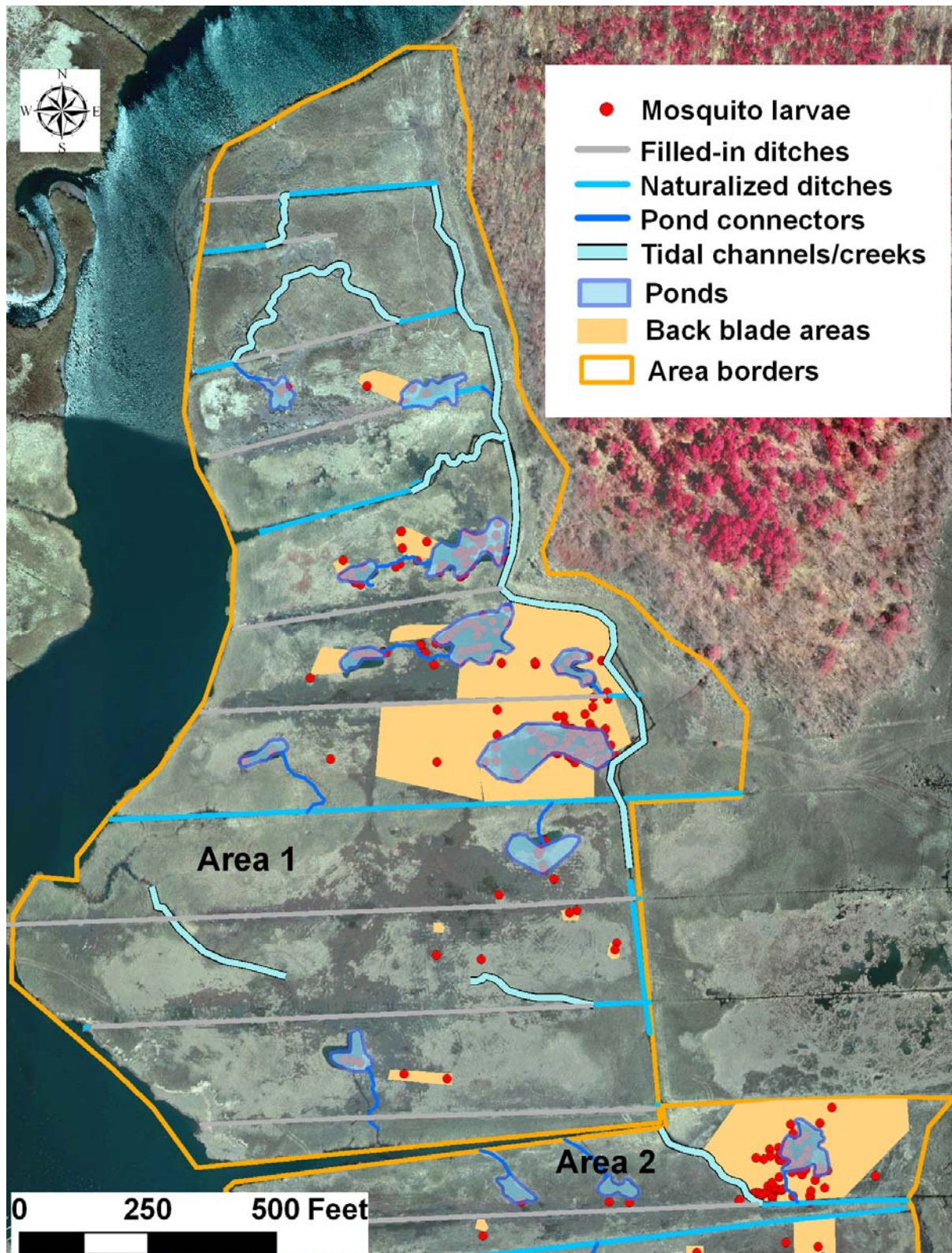


Figure 2-4. Area 1 Overlay of Pre-Treatment Mosquito Larvae Locations and Project's Elements



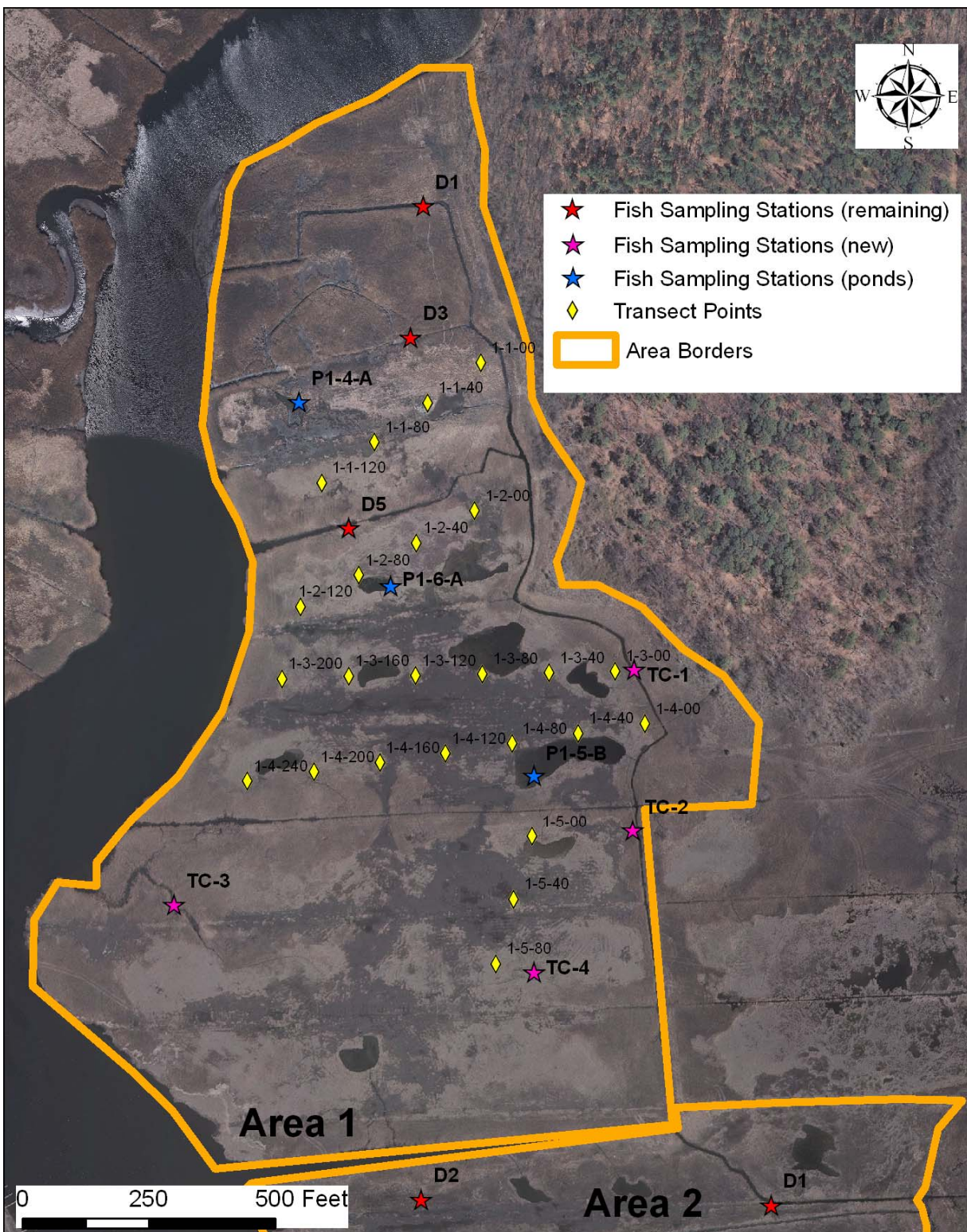


Figure 2-5. Area 1 Post-Treatment, Nekton Sampling Locations and Transect Locations



## **2.2 Area 2**

Area 2 is approximately forty-seven acres in size. This area was treated from January 30, 2006 through March 30, 2006. Figure 2-6 shows the original Area 2 nekton sampling stations and the transect locations, which remain intact after the construction. Mosquito larvae (transects), pore water salinity, water table heights, and vegetation quadrat are measured at the transect locations. Figure 2-7 outlines the Plan for the placements of the ponds, the tidal creek or channel, sills, filled ditches, and backbladed areas. The inclusions of targeted mosquito larval locations indicate the reason for the placements of these elements. Figure 2-8 shows the placement of the new nekton sampling stations post-construction and illustrates that the transect locations are intact in their original locations.

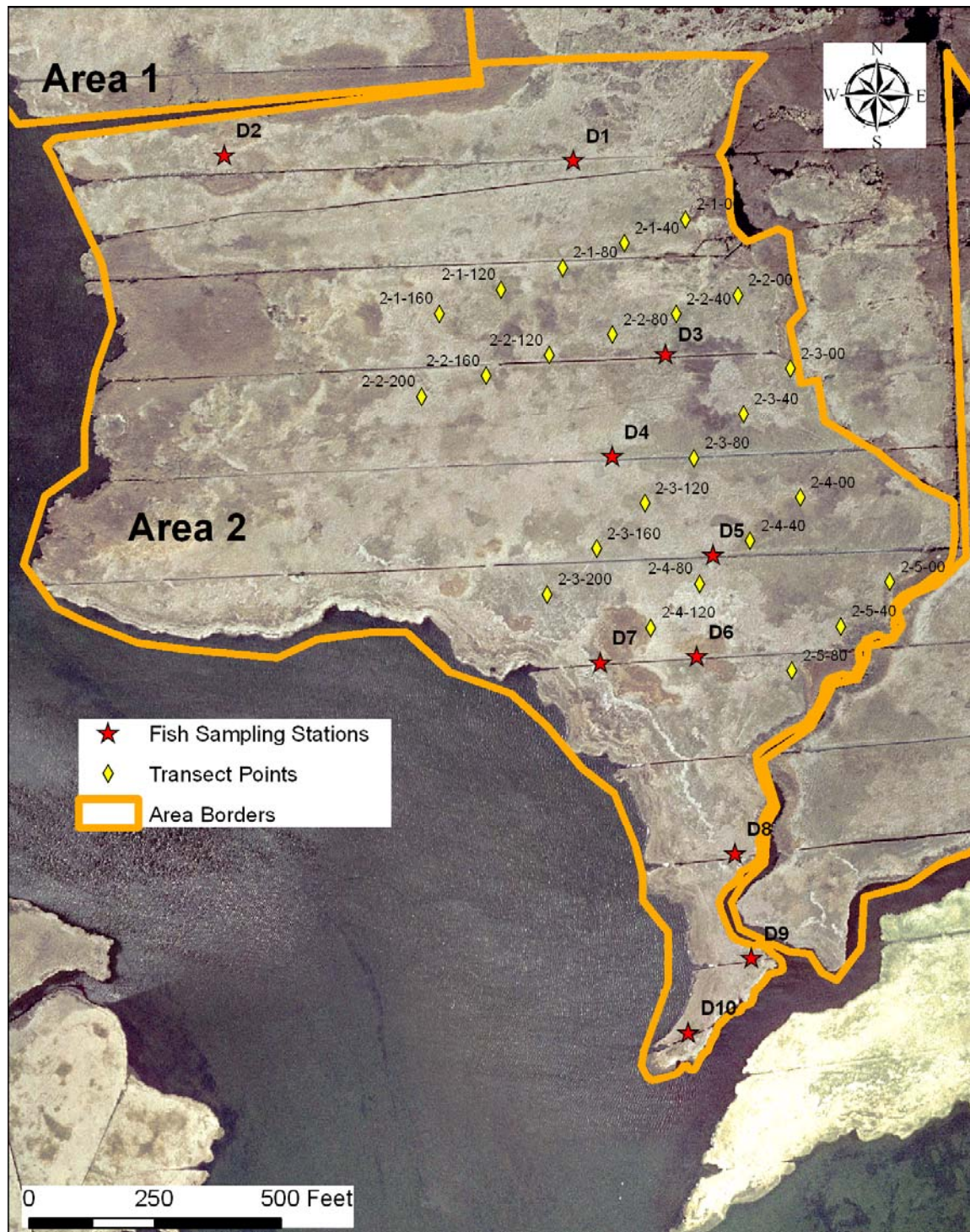


Figure 2-6. Area 2 Sampling Stations, Pre-Treatment



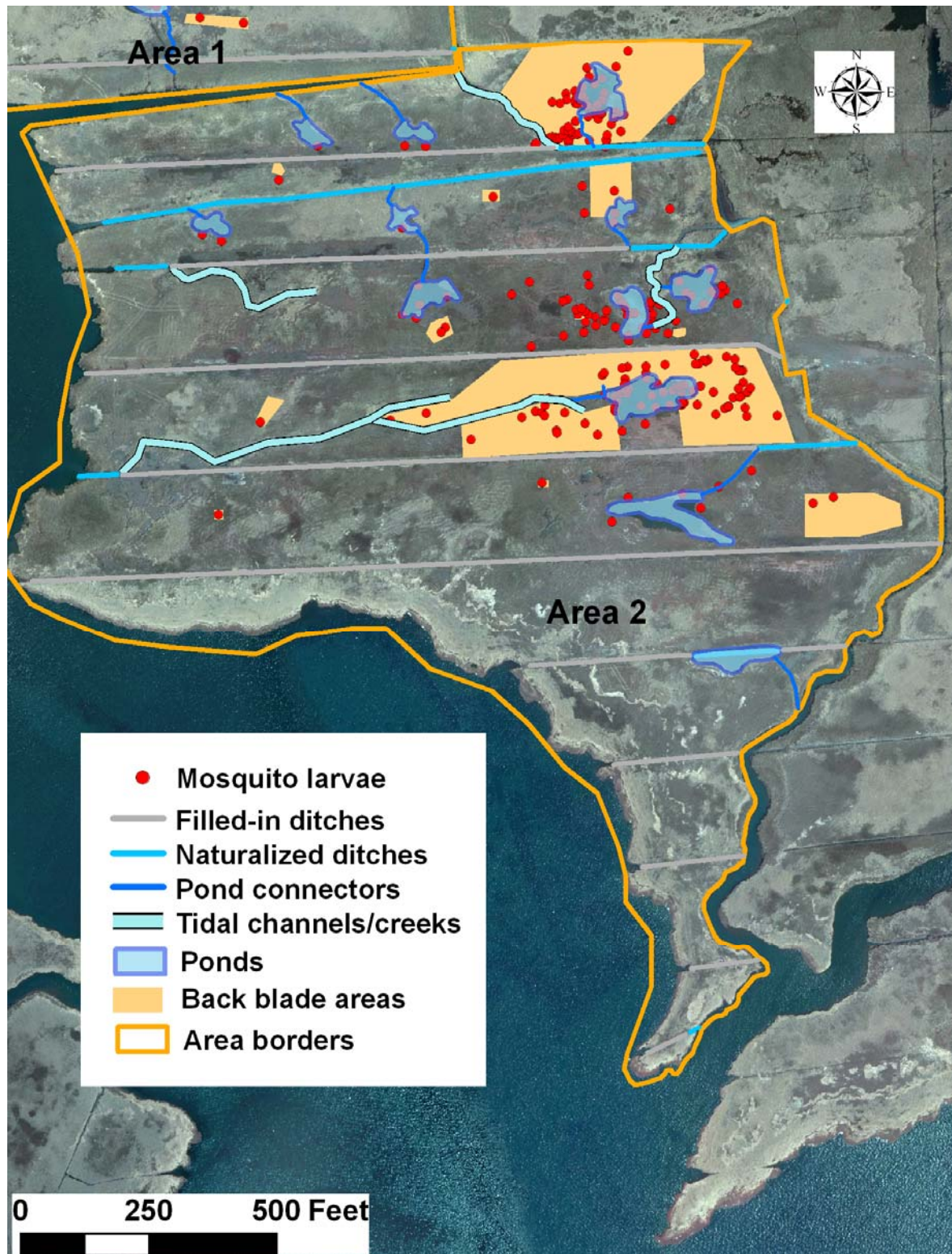


Figure 2-7. Area 2 Overlay of Pre-Treatment Mosquito Larvae Locations and Project's Elements



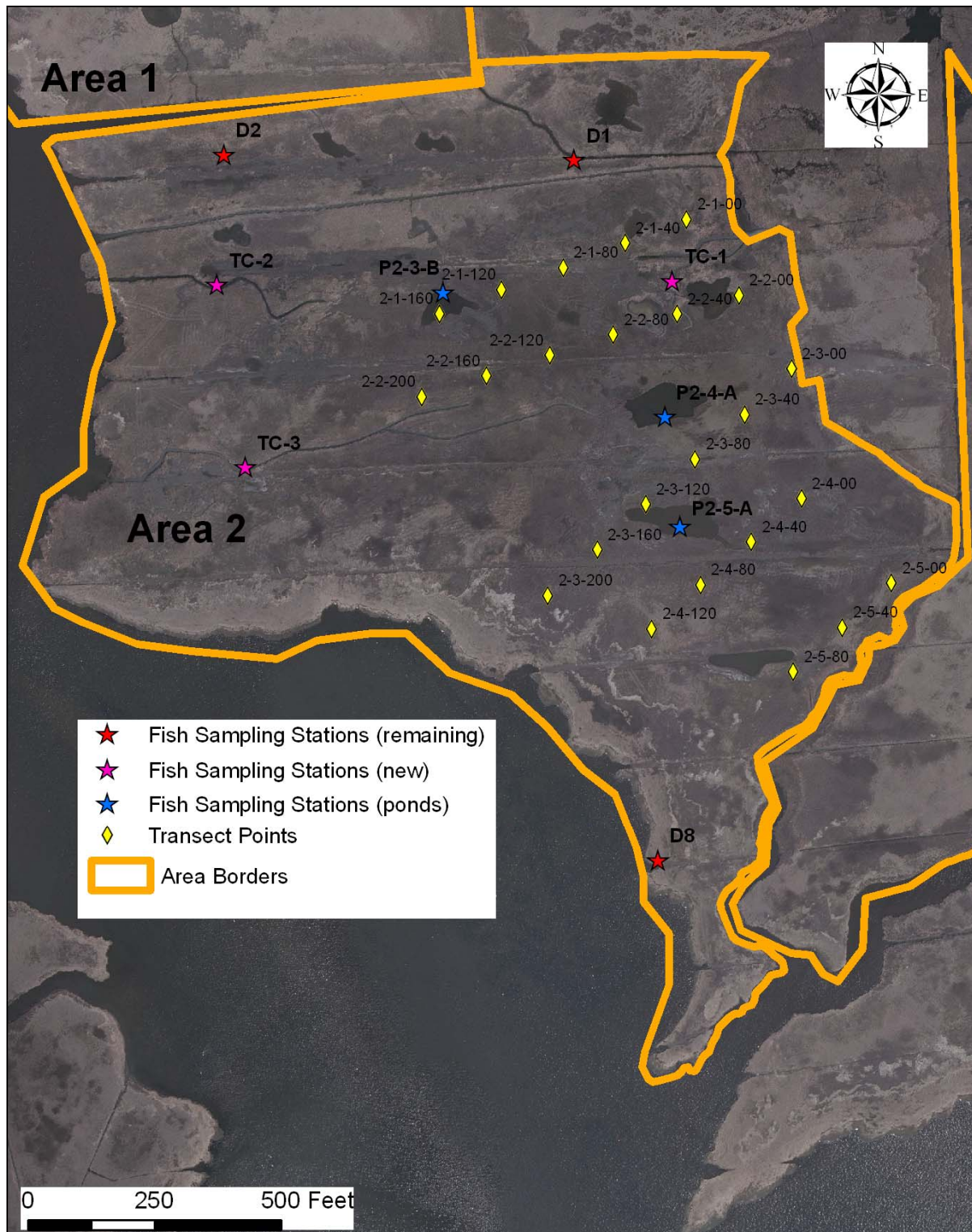


Figure 2-8. Area 2 Post-Treatment, Nekton Sampling Locations and Transect Locations

### 2.3 Area 3

Area 3 is approximately twenty-five acres. Area 3 was not altered and served as one of the control areas. Sampling stations for nekton remain the same in this control marsh pre- and post-construction. Refer to Figure 2-9 for the sampling stations in Area 3.



Figure 2-9. Area 3 Nekton Sampling Locations and Transect Locations

### 2.4 Area 4

Area 4 is approximately forty-six acres. Area 4, like Area 3, was not altered and served as the second control area. Nekton sampling stations remain the same in this control marsh pre- and post-construction. The sampling stations in Area 4 are outlined in Figure 2-10. From 2005 to 2008, USFWS conducted its Phragmites control program, which is not



within the scope of this project. Out of all of the four areas, Area 4 was most impacted by these efforts of Phragmites control. Refer to the Report Addendum for information on this Phragmites control program.



Figure 2-10. Area 4 Nekton Sampling Locations and Transect Locations

### **3.0 Methodology**

#### **3.1 General Study Design**

This study employed a paired BACI (Before, After, Control, Impact) study design (James-Pirri et al., 2008). Four areas were selected that included two treatment marshes (Areas 1 and 2) and two control marshes (Areas 3 and 4). The treatment marshes and control marshes were sampled prior to any hydrologic alteration (Before) and after the hydrologic alterations were performed on the treatment marshes (After: 2005-08 for Area 1 and 2006-08 for Area 2). In this BACI design, the practice of hydrologic alteration (*i.e.*, OMWM and marsh restoration techniques) was the "Impact" and the unaltered control marsh was the "Control".

To monitor the marsh parameters, five transects were laid out in Area 1 and Area 2, and four transects were laid out in Area 3 and Area 4. The transect delineation followed the procedure outlined in James-Pirri et al. (2008). Transects were plotted in the upland portion of the marsh and extended towards Carmans River. The initial station location was identified using a random number generator along each transect, and the stations were located every forty meters from the initial sampling point. Thus, a total of twenty-four stations were located in Area 1 and Area 2, and twenty stations were set in Area 3 and Area 4, for a total of eighty-eight sampling stations (Figure 3-1).

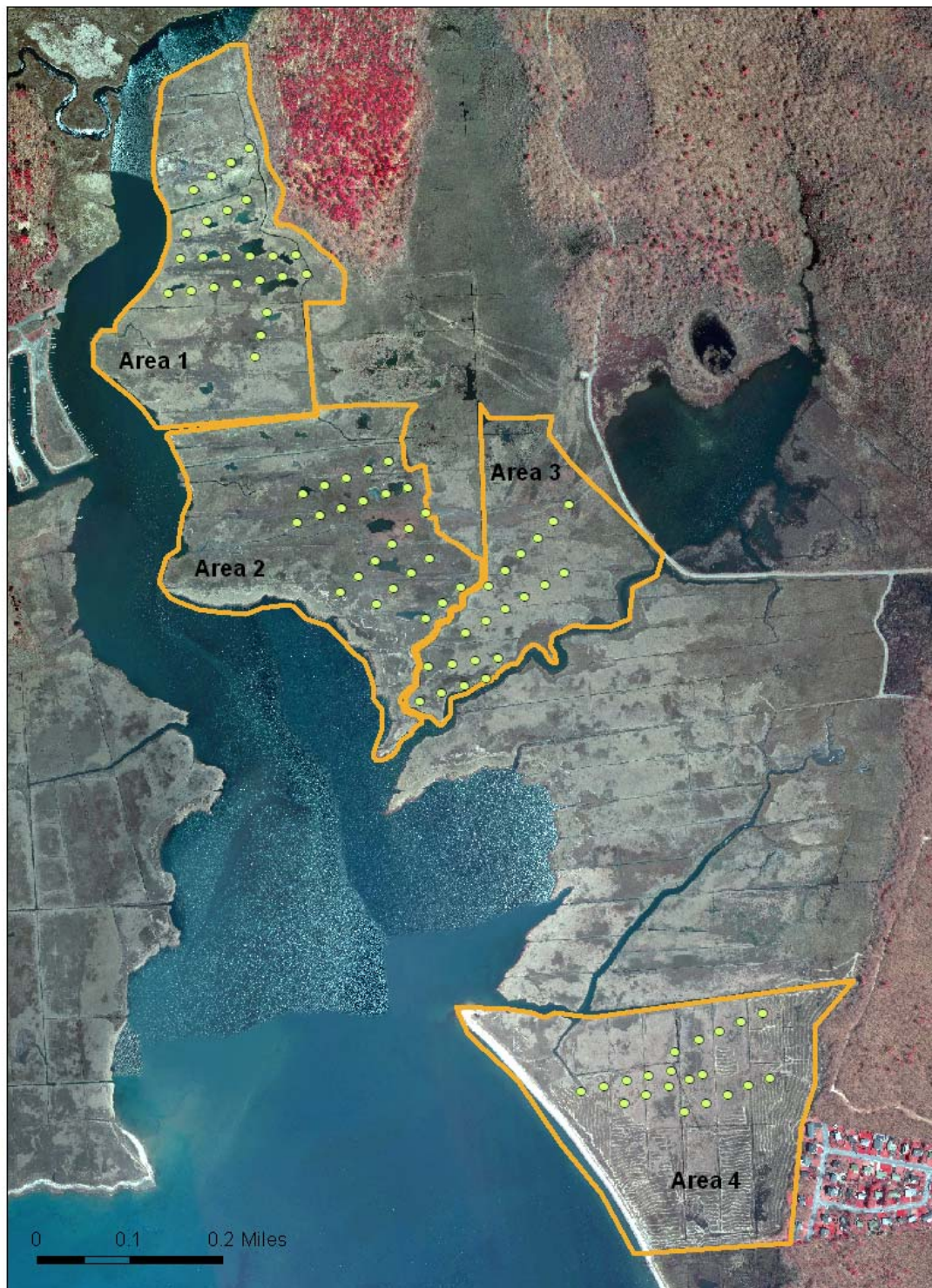


Figure 3-1. Transect sampling locations



### **3.2 Physical Parameters**

#### **3.2.1 Water Table Height Sampling Protocol**

Water table measurements were collected following published protocols (James-Pirri et al., 2002&) using the eighty-eight groundwater monitoring wells set at the sampling stations and sampling during low tide periods. These wells were constructed from PVC pipes with a four centimeter diameter and seventy centimeters in length. They were installed sixty centimeters below the marsh surface. Holes were drilled into the pipe to allow water to percolate into the well. The top ten centimeters of the pipe was left intact to prevent surface water from entering the well. The wells were capped with PVC caps. They were located one meter out from each of the eighty-eight transect stakes orientated west of the transect line. The distance inside the well, from the top of the PVC pipe, to the water level and the outer height of the well above the marsh surface were measured using a meter stick. The height of the water table was calculated as the difference between the height of the well above the marsh surface and the distance from the top of the well to the water. If the water level was below the marsh surface, the resulting value was negative; if the water level was above the marsh surface (*i.e.*, flooded marsh), the resulting value was positive. Water table height sampling occurred every fourteen days between May and October, for a total of eleven sampling events in 2008.

### **3.3 Chemical Parameters**

#### **3.3.1 Pore Water Salinity Sampling Protocol**

Pore water salinity was measured at the eighty-eight water table height transect stations, following published protocols (James-Pirri et al., 2002&) during low tide periods. A soil probe was inserted into the soil near the groundwater wells to extract water from fifteen centimeters below the marsh surface. If no water was obtained from the this fifteen cm depth, another attempt was made at thirty cm or forty-five cm depths and recorded accordingly. A few drops of the extracted water were placed on a hand-held refractometer and the salinity reading was recorded. If

no sample could be obtained, a "dry" sample value was recorded. At the same time the water table heights were measured, pore water salinity was measured for a total of eleven times in 2008.

### **3.3.2. General Water Quality Sampling Protocols**

At each of the fish stations, hand-held YSI multi-parameter meters were used to collect salinity, temperature, and dissolved oxygen concentrations measurements per James-Pirri et al. (20028). These measurements were taken three times in 2008 coinciding with nekton sampling.

## **3.4 Biological Parameters**

### **3.4.1 Vegetation Sampling**

Four methods were used to assess the marsh vegetation: vegetation quadrat sampling for plant species composition, above and below-ground vegetation biomass sampling, marsh vegetation composition, and photo stations.

#### **3.4.1.1 Vegetation Quadrat Sampling Protocol**

Marsh vegetation was sampled within 1m<sup>2</sup> vegetation quadrats that were delineated at the 88 transect stations according to the established procedure (James-Pirri et al., 20028). The point intercept method (50 point grid) was used to determine cover type percentages. Five dowels measuring one meter in length were marked with ten evenly spaced marks, 11.1 centimeters apart. The five dowels are placed parallel to each other at a twenty cm distance. See Figure 3-2. Plant species at each mark were identified and the total number of times each species found was tallied for each quadrat. Live and dead vegetation were separated during the identification process. In addition to plant species, other cover types included algae, bare ground, water, and wrack (*i.e.*, loose dead material on the marsh surface). To obtain percentage cover type, the total number of hits for each cover type was divided by 50. All eighty-eight transect

sampling stations were sampled at the end of the growing season from September 22nd till September 24th, when plants were full grown and thus easily identifiable.



Figure 3-2. Vegetation quadrat sampling dowels

#### **3.4.1.2 Vegetation Biomass Sampling Protocol**

The above-ground and below-ground biomass sampling method was adopted from Allison, 1996). For above-ground biomass sampling, forty-four (*i.e.*, one-half) of the transect stations were selected randomly by Area (Table 3-1). For below-ground sampling, twenty-two (*i.e.*, one-quarter) of the transect stations were randomly selected by area (Table 3-

2). A 25.4 cm (10 in) diameter metal wire ring was cast in a haphazard fashion from the selected sampling stations. All above-ground vegetation within the ring was cut and separated into dead and live material. The below-ground core samples were collected within the ring using a 20 x 8 cm (length x diameter) core sampler. Upon removal of the core from the sampler, the length of the soil core was recorded to the nearest centimeter. The soil core samples were rinsed with flowing water to remove all soil material and the excess water removed from the remaining plant material. The wet samples were weighed, and then dried in an oven at 105°C for twelve hours. The dry samples were weighed and the resulting values were used to calculate the dry weight vegetation biomass.

**Table 3-1. Above-ground Vegetation Biomass Stations, 2008**

Area 1	Area 2	Area 3	Area 4
2-00	1-40	1-00	1-40
2-40	1-120	1-80	2-80
2-80	1-160	1-200	3-00
2-120	2-00	2-80	3-40
3-00	2-40	2-120	4-80
3-40	2-80	2-160	4-120
3-80	3-40	2-200	
3-120	3-80	3-40	
3-160	3-120	3-120	
4-80	4-40	4-80	
4-120	4-80		
4-160	5-00		
5-00	5-40		
	5-80		

**Table 3-2. Below-ground Biomass Stations, 2008**

Area 1	Area 2	Area 3	Area 4
3-200	1-00	1-00	1-40
4-80	1-40	1-80	2-80
4-160	2-00	1-120	3-00
4-200	2-80	1-160	3-40
4-240	5-40	1-200	4-80
5-00			4-120

#### **3.4.1.3 Marsh Vegetation Composition Sampling Protocol**

Marsh vegetation composition map was created through ground-truthing aerial photographs. An initial approximation of the vegetation composition was made, characterizing the vegetation in terms of high marsh (areas dominated by *S. patens*), low marsh (areas dominated by *S. alterniflora*), mixed marsh (primarily low form *S. alterniflora* and *S. patens*), areas dominated by the invasive Phragmites. These boundaries were then ground-truthed, delineated on the aerial orthophotographs, and transferred to the computer in ArcGIS environment. The 2008 sampling was conducted in the fall, on October 20<sup>th</sup> and 21<sup>st</sup>, at the end of the vegetative growing season.

#### **3.4.1.4 Photo Stations Sampling Protocol**

Twenty nine permanent photo stations were established in 2004 for visual documentation of any vegetation changes. See Figure 3-3. The placement of the photo stations in Areas 1 and 2 were determined based on locations of the proposed alterations and the use of aerial photographs. Where possible, photo stations were located at the original fish stations, or at the transect points. A six foot ladder was positioned at each photo station and panoramic photographs were taken in four cardinal directions using digital camera from approximately eight feet in height above the marsh surface. The 2008 vegetation photographs were taken in October, near the end of the vegetative growing season.



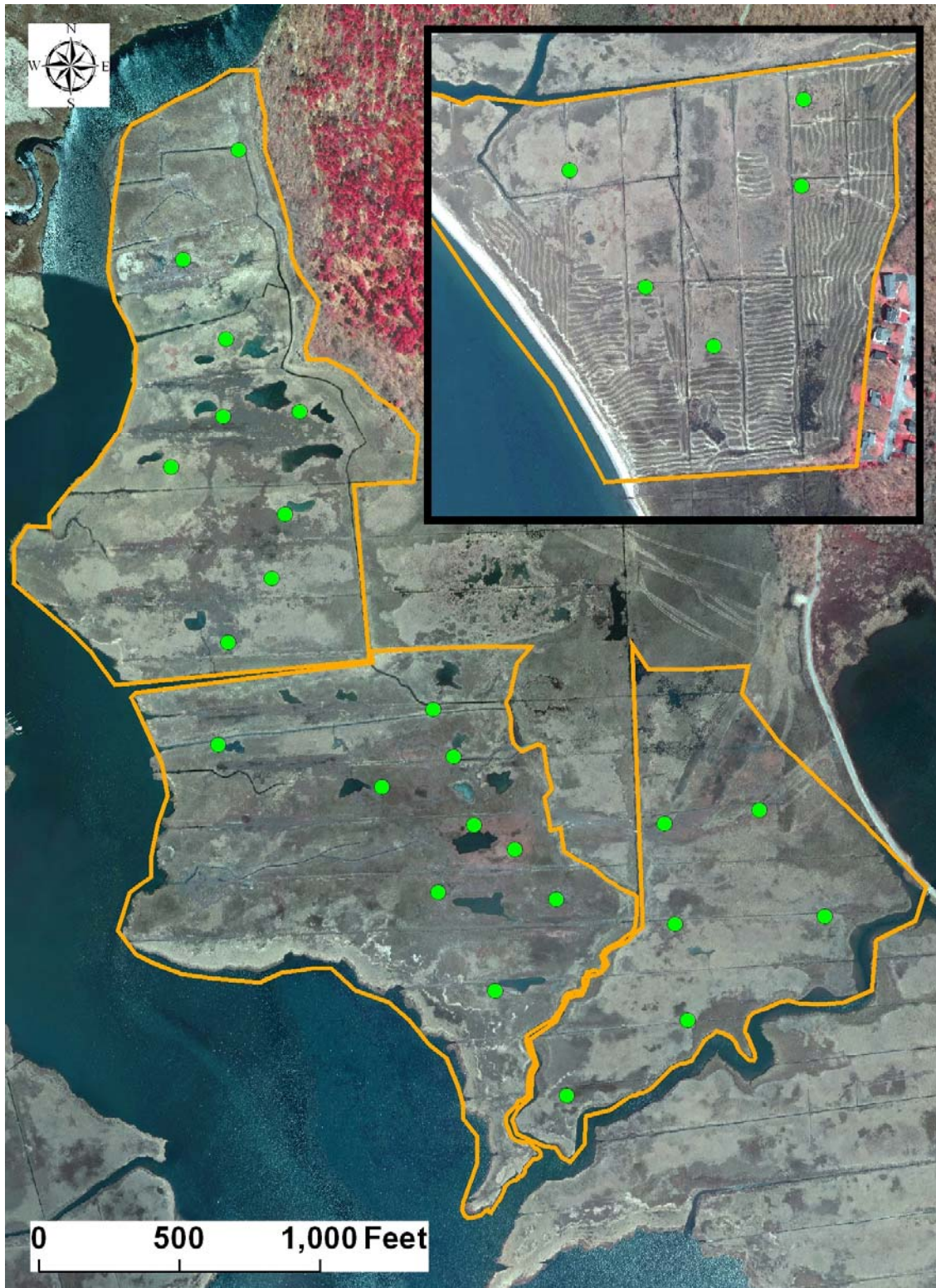


Figure 3-3. Photo stations locations (green dots). Area 4 is shown in the insert.

### **3.4.2 Larval Mosquito Sampling Protocols**

Immature mosquito stages (*i.e.*, larvae and pupae) were sampled using a standard mosquito dipper. The larval development stage or instars was determined in the field and the data entered into a hand held Personal Digital Assistant (PDA) (Dell Axim) coupled with a Global Positioning System (GPS) receiver (Holux GPSlim 236) to record precise geographic location of the sample. Custom designed software installed on the PDA allowed entering additional parameters, such as sampling type, habitat, presence of standing water, and comments. The results were stored in the PDA memory and automatically transferred into a MicroSoft Access database after each sampling event was completed. At least one representative immature mosquito sample from each area was brought to the laboratory for microscopic species identification. Two sampling procedures were employed to collect larval data: sampling at transect stations (monthly) and targeted sampling (weekly).

#### **3.4.2.1 Larval Sampling at Transect Stations**

A systematic sampling protocol (James-Pirri et al., 2008) was carried out at the eighty-eight transect stations and points in between (*i.e.*, at every twenty meters). Larval mosquito samples were collected monthly (May through September), four - five days following a high tide inundation to maximize the chances of finding mosquito larvae on the salt marsh.

#### **3.4.2.2 Targeted Larval Sampling**

The second procedure utilized targeted sampling, a more common method used by mosquito control professionals, whereby suitable larval habitats, *i.e.*, pools of standing water, were searched for across all four areas. These surveys intended to be comprehensive, so the majority of potential larval habitats within an area were sampled each time. At least twenty-five samples were obtained per area per visit unless the marsh surface was

either dry (no standing water) or completely flooded. Each area was visited weekly for targeted sampling from early May to mid September, a period corresponding to the active mosquito season in this region.

### **3.4.3 Nekton**

#### **3.4.3.1 Nekton Sampling Protocols**

Nekton sampling was conducted following published protocols (James-Pirri et al., 2008). Nekton was sampled using two habitat-dependent enclosure sampling gears, each with three mm mesh netting. A one m<sup>2</sup> throw trap was used to quantify nekton in salt marsh ponds in Areas 1 and 2 and a ditch net was used to sample mosquito ditches and tidal channels in all four areas. The species abundance of nekton (fish and decapods) was recorded at each station and total lengths were measured for fifteen randomly selected individuals of each species (fish only). For fish species, identification to species was attempted for each individual. In some instances individuals could not be identified to species due to small size or difficult morphology; these individuals were identified to the level of genera. Water depth, water temperature, water salinity, and the amount of dissolved oxygen (DO) were measured and recorded using a ruler and YSI digital temperature/salinity/DO meters, respectively. In 2008, nekton was sampled three times; in June (spring), August (summer), and October (fall).

#### **3.4.3.2 Nekton Sampling in Ditches or Tidal Channels**

Ten ditch stations were set in Areas 3 and 4 and seven ditch/tidal channel stations were set in Area 1 and six stations in Area 2, following the alterations. A nylon ditch net with three mm (1/8 in.) mesh size was used to sample ditches and tidal channels. See Figure 3-4. Each ditch net was placed along both sides and the bottom to cover the entire width of the ditch/tidal channel. The distances between the ditch net stakes were



measured and recorded to calculate the sampling area. The ditch nets were deployed for at least thirty minutes followed by quick retrieval of the gear.



Figure 3-4. Ditch net to collect nekton in ditches or tidal channels

#### **3.4.3.3 Nekton Sampling in Ponds**

Three pond sampling stations were set in both Area 1 and Area 2 following their alterations. Sampling at the pond locations was conducted using published protocols (James-Pirri et al., 2008). A one m<sup>2</sup> throw trap with three mm nylon netting was deployed from a randomly selected position along the perimeter of each pond, and the catch extracted using a dip net. See Figure 3-5. If no nekton was collected during the first attempt, two additional attempts were made. If the three consecutive samplings did not yield any nekton, the value of zero was recorded.



Figure 3-5. Throw trap and dip net used to collect nekton in ponds

#### 3.4.4 Bird Sampling Protocol

Avian assemblage and use of the study site was surveyed using stationary sampling points and walking points. A total of thirty points were sampled during each survey. There were a total of seventeen stationary points and thirteen walking points. See Table 3-3 and Figure 3-6.

**Table 3-3. Total Number of Bird Point Counts per Area**

Area	# of Stationary Points	# of Walking Points	Total Point Count	Area (ha)
Area 1	5	4	9	16.0
Area 2	5	4	9	18.9
Area 3	3	2	5	10.7
Area 4	4	3	7	18.5



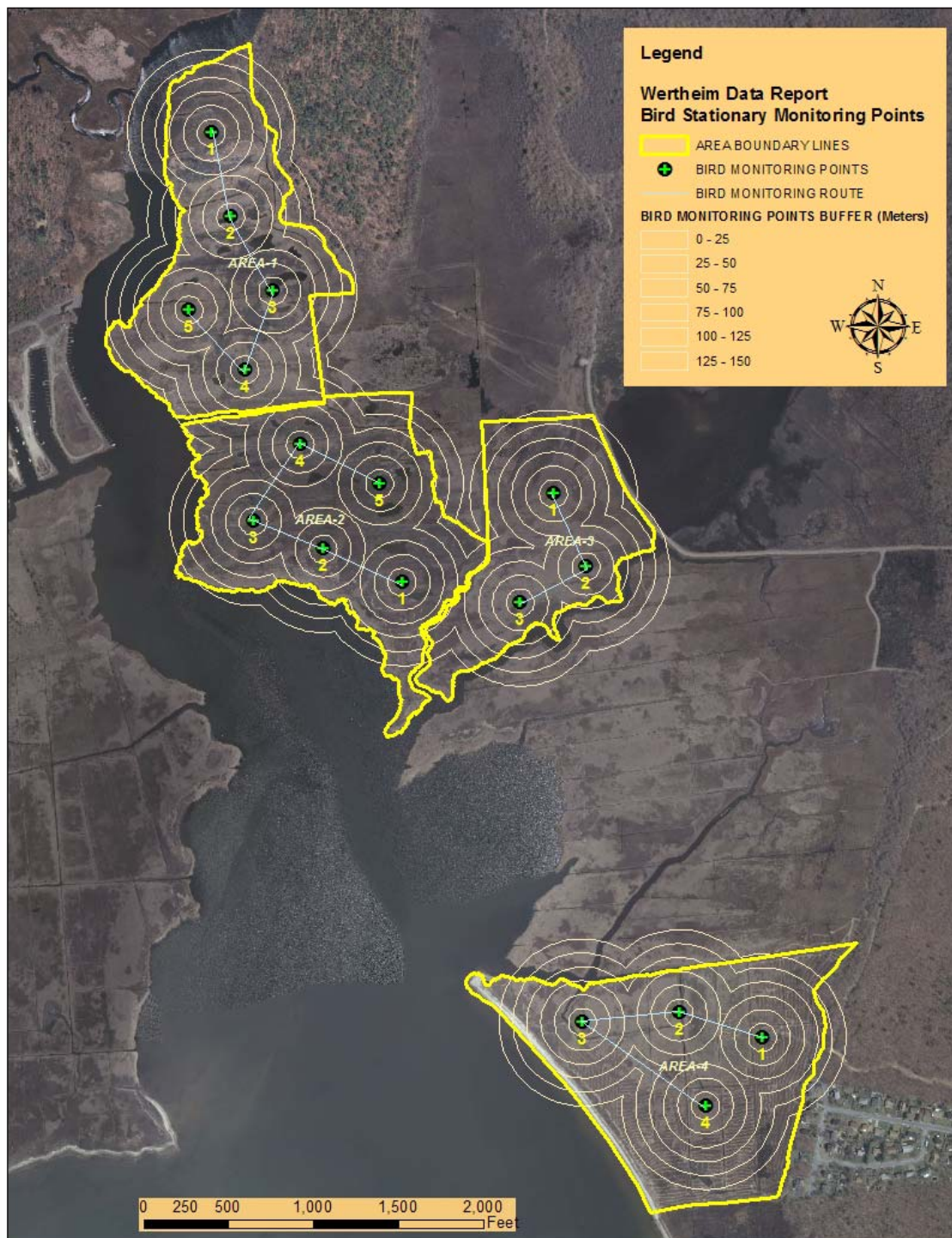


Figure 3-6. Bird Stationary Monitoring Points, Areas 1 – 4 and Walking Route

Observers, using binoculars, recorded each bird observed or heard over a ten minute period and the total number for each species. Distance to the observed bird was also recorded in twenty-five meter intervals out from the stationary point to one hundred and fifty meters. Birds observed walking between points were also noted. Birds that flew over the survey site during sampling were recorded as well. There were a total of four surveys conducted in 2008; one winter and three surveys during the summer. See Table 3-4.

**Table 3-4. 2008 Bird Survey Effort**

Season	Dates	Area 1	Area 2	Area 3	Area 4
<i>Winter</i>	January 1 – March 31	1	1	1	1
<i>Summer</i>	June 1 – September 5	3	3	3	3
	<b>Total Surveys</b>	<b>42</b>	<b>21</b>	<b>24</b>	<b>23</b>

#### 4.0 Statistical Data Analysis

Area and treatment were the two main independent variables used in the statistical analyses of 2008 data. There were four Areas numbered 1 through 4, with Areas 1 and 2 constituting the treatment group (*i.e.*, OMWM and marsh restoration) and Areas 3 and 4 constituting the control group. An Analyses of Variance (ANOVA) using a nested model, areas within treatment (treatment + area (treatment)) was used to determine differences between treatments (*i.e.*, treatment effect) and among the four areas. For nekton length and pore water salinity, individual sampling stations were also entered as a term in the model. If the nested term was significant, then a Scheffe post-hoc test was done to determine which areas were significantly different. Data were checked for ANOVA assumptions of normality, heterogeneity of variances, and homoscedascity. If the assumptions were not met the data were transformed or ranked; non-parametric tests (Mann-Whitney U and/or Kruskal-Wallis) with Bonferroni adjustment for multiple comparisons were used as an alternative if the data did not meet the assumptions.

Community composition (nekton, vegetation, and birds) were compared by Analysis of Similarities (ANOSIM) (Clarke & Gorley, 2006) to determine differences between treatment and control (*i.e.*, treatment effect) and among the four areas following the established protocol

(James-Pirri et al, 2008). ANOSIM is a nonparametric analog to multivariate analysis of variance (MANOVA) utilizing a multivariate permutation procedure that analyses both species composition and abundance. The ANOSIM procedure calculates a similarity measure and a similarity matrix that allows for the objective identification of samples (*i.e.*, vegetation plots or nekton/bird sampling stations) that have similar (or dissimilar) communities in terms of species composition and abundance or percent cover. The Bray Curtis similarity metric was used to create similarity matrices for both datasets. All pair-wise comparisons were summarized into a test statistic using Clark's R that compared between-group to within-group dissimilarities. Clark's R statistic ranges from 0 to 1, with 0 indicating communities were completely similar and 1 indicating that communities were completely dissimilar. Monte Carlo permutation tests were run 99999 times and were then used to derive p-values. Bonferroni correction was made based on the number of comparisons being tested. The datasets were not transformed prior to ANOSIM analyses.

For pair-wise comparisons that were significant, or had dissimilar communities, it is often desirable to know what contribution the individual cover types or species made to the overall dissimilarity. The proportion of the overall dissimilarity that was contributed by individual cover types or species was calculated using the Similarity Percentages routine (SIMPER) and the Bray-Curtis similarity measure (Clarke & Gorley, 2006). The outcome was a list of cover types or species ranked in order of their percent contribution to the dissimilarity between significant pair-wise comparisons.

ANOSIM and SIMPER tests were performed by Dr. MJ James-Pirri (University of Rhode Island), who also provided generous assistance and advice with the interpretation and analysis of the results.

## **5.0 Results**

### **5.1. Physical Parameters**

#### **5.1.1 2008 Water Table Height**

Average water table level at each area was computed (Table 5-1) and compared using nested ANOVA (treatment+ area (treatment)) + station (area (treatment)) to determine the main effects of treatment, area (nested within treatment), and each sampling station (nested within area and treatment). The treatment the nested area terms were not significant ( $p=0.583$  and  $p=0.131$ , respectively), while the nested station term was statistically significant ( $p<0.001$ ). These findings suggest that there was no statistically significant treatment effect on water table level, and no significant water table level differences among the four areas. The variability among different stations within each area or treatment type was greater than the variability among different areas or between treatment and control marshes.

**Table 5-1. Average Water Table Level (cm) and Standard Deviation**

Area	Water Table Level (cm)	
	Mean	SD
1	-5.3	6.7
2	-4.4	7.4
3	-5.3	6.9
4	-2.8	6.9

## 5.2 Chemical Parameters

### 5.2.1 2008 Pore Water Salinity

Average pore water salinity at each area was computed and compared using nested ANOVA (treatment + area (treatment) + station (area(treatment))) to determine the main effects of treatment, area (nested within treatment), and each sampling station (nested within area and treatment). The treatment term was not significant,  $p=0.776$ , while the nested area and station terms were statistically significant ( $p=0.001$  and  $p<0.001$ , respectively). These findings suggest that there

was no statistically significant treatment effect on pore water salinity, but it varied significantly among areas when the variability in pore water salinity among the sampling stations was controlled for. Scheffé post-hoc test was used to determine which of the four areas were significantly different at  $p < 0.05$  (Table 5-2). Area 1's pore water salinity was significantly lower than that at the other three areas, followed by Area 4, which was intermediate. Areas 2 and 3 had the highest salinities similar to each other.

**Table 5-2. Average Pore Water Salinity (ppt) and Standard Deviation.**  
**Letters indicate Statistical Significant Differences by Scheffe Post-hoc Test.**

Area	Pore water salinity (ppt)	
	Mean	SD
1	14.3 <sup>a</sup>	3.5
2	19.5 <sup>b</sup>	6.1
3	18.8 <sup>b</sup>	5.0
4	16.8 <sup>c</sup>	7.2

To visualize pore water salinity distribution, average salinity values from transect sampling stations were extrapolated over the four areas using IDW (Inverse Distance Weighted) function in ArcGIS v. 9.2. See Figure 5-1.

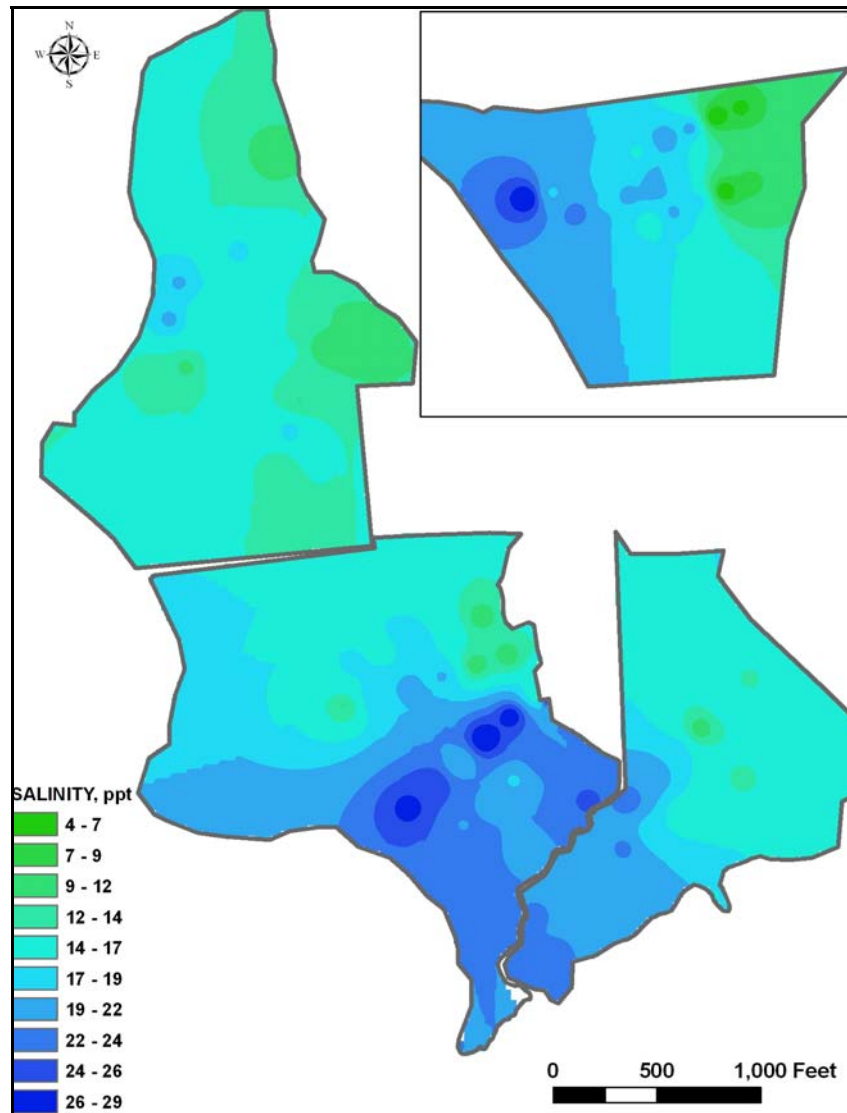


Figure 5-1. Average Pore Water Salinity Values (ppt) across all Four Areas extrapolated from Transect Sampling Stations.

Pore water salinity values were evaluated using average standardized Z-scores, which varied from exceptionally low (*i.e.*, Z-score=-2) to exceptionally high (*i.e.*, Z-score=2). The averaged Z - score values at each station were extrapolated over the four areas using IDW method. See Figure 5-2.



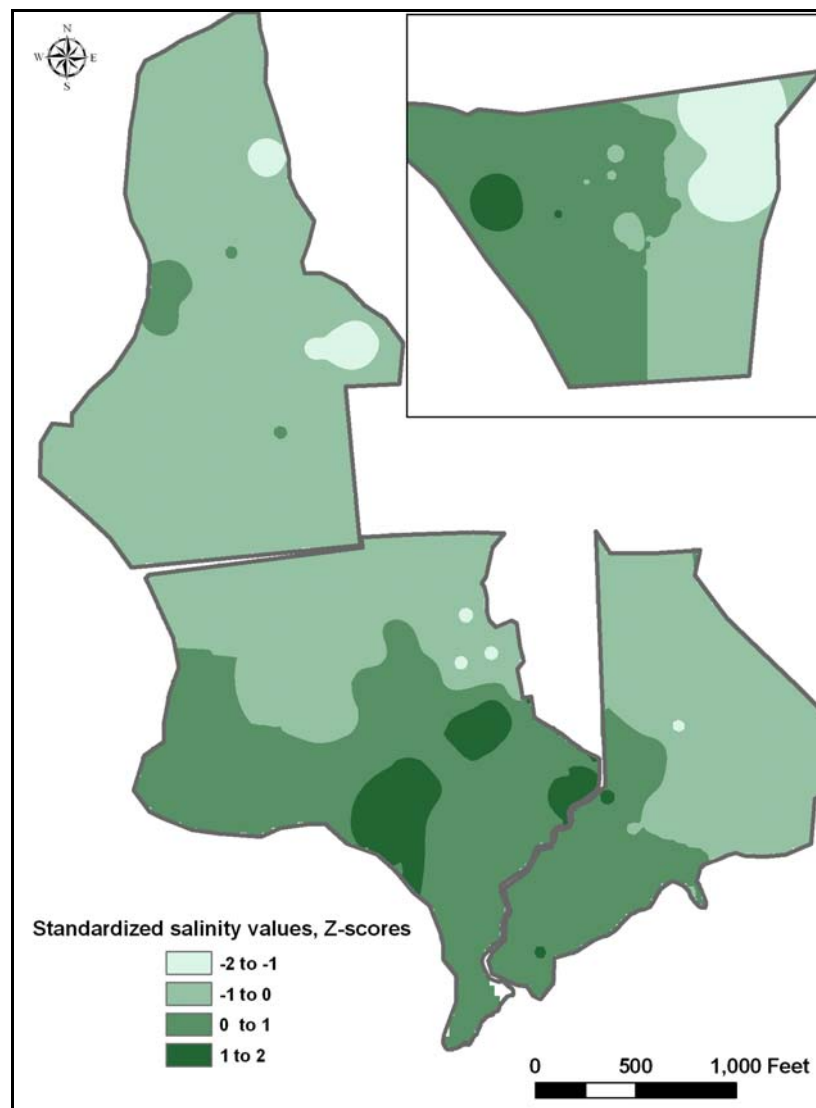


Figure 5-2. Average Pore Water Salinity Z-scores, across all Four Areas extrapolated from Transect Sampling Stations. The Standardized Z-scores vary from -2 (exceptionally Low) to 2 (exceptionally High).

Locations with high pore water salinity variability were identified based on the standard deviation (SD) values at each station and extrapolated to a map using IDW method. See Figure 5-3. Higher SD values correspond to higher variability in pore water salinity values over the course of the season.

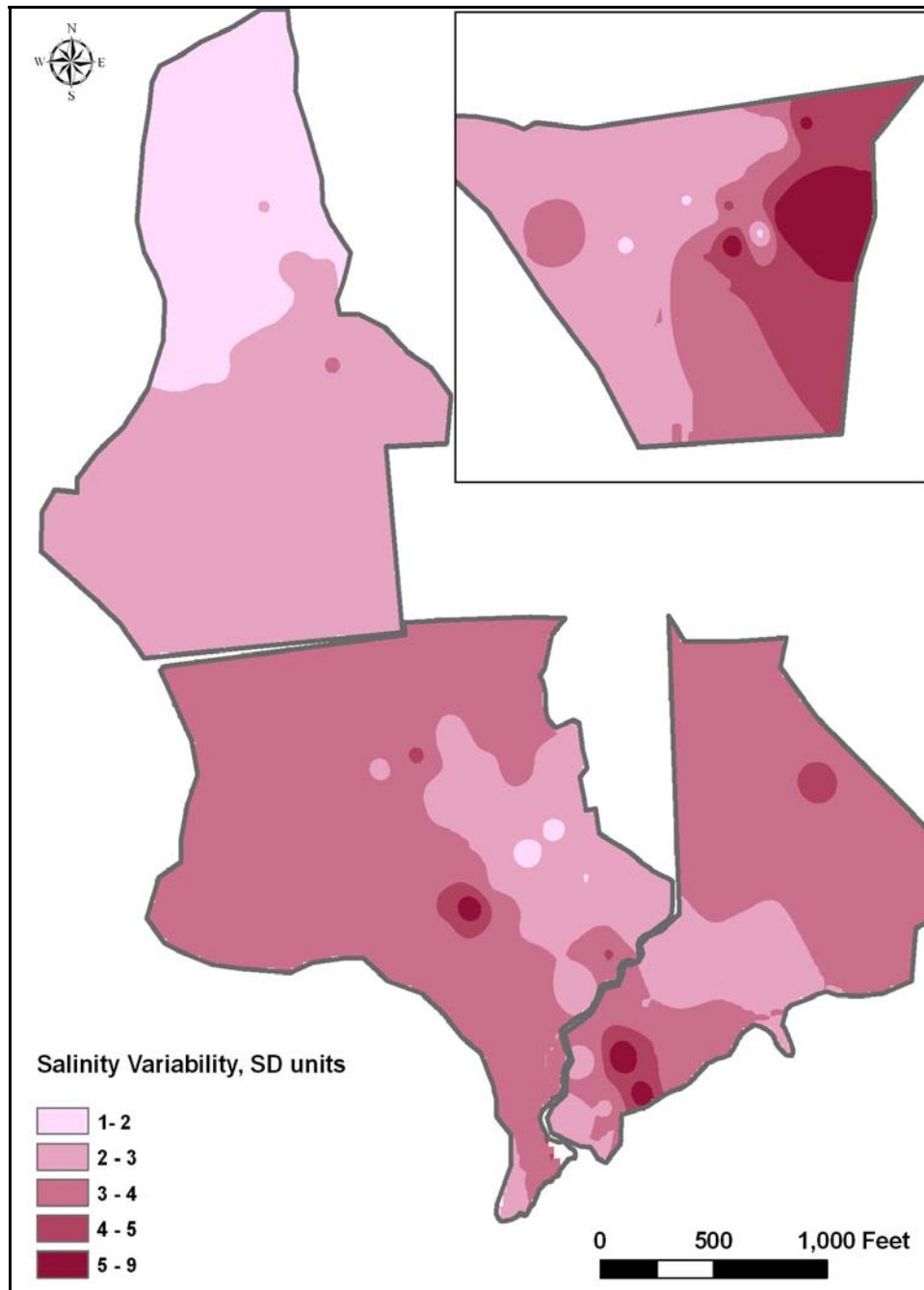


Figure 5-3. Pore Water Salinity Variability in Standard Deviation (SD) Unit Values across all Four Areas extrapolated from Transect Sampling Stations. Higher Values correspond to higher Variability.

## **5.3 Biological Parameters**

### **5.3.1 2008 Vegetation Parameters**

#### **5.3.1.1 Vegetation Quadrat Sampling**

In each of the study areas, between ten to fourteen plant species were identified (Table 5-3). Two new species were found for the first time in 2008: *Polygonum ramosissimum* (bushy knotweed) in Area 1, and *Cyperus filicinus* (fern flatsedge) in Area 4.

**Table 5-3. Plant Species per Area 2003-2008**

**AREA 1**

<b>2003 (10)</b>	<b>2004 (9)</b>	<b>2005 (10)</b>	<b>2006 (11)</b>	<b>2007 (11)</b>	<b>2008 (154)</b>
Phragmites australis	Phragmites australis	Phragmites australis	Phragmites australis	Phragmites australis	Phragmites australis
Distichlis spicata	Distichlis spicata	Distichlis spicata	Distichlis spicata	Distichlis spicata	Distichlis spicata
Iva frutescens	Iva frutescens	Schoenoplectus robustus	Iva frutescens	Aster nemoralis	Iva frutescens
Limonium carolinianum	Limonium carolinianum	Pluchea purpurascens	Schoenoplectus robustus	Schoenoplectus robustus	Aster nemoralis
Pluchea purpurascens	Pluchea purpurascens	Solidago sempervirens	Pluchea purpurascens	Pluchea purpurascens	Schoenoplectus pungens
Solidago sempervirens	Solidago sempervirens	Schoenoplectus pungens	Solidago sempervirens	Solidago sempervirens	Schoenoplectus robustus
Schoenoplectus pungens	Schoenoplectus pungens	Spartina patens	Schoenoplectus pungens	Schoenoplectus pungens	Pluchea purpurascens
Spartina patens	Spartina patens	Eleocharis parvula	Spartina patens	Spartina patens	Solidago sempervirens
Eleocharis parvula	Spartina alterniflora	Spartina cynosuroides	Eleocharis parvula	Eleocharis parvula	Spartina patens
Spartina alterniflora		Spartina alterniflora	Salicornia sp.	Spartina cynosuroides	Eleocharis parvula
			Polygonum	Spartina alterniflora	Salicornia sp.
			hydropiperoides		Spartina cynosuroides
					Spartina alterniflora
					Polygonum ramosissimum
					Aster subulatus

**AREA 2**

<b>2003 (6)</b>	<b>2004 (7)</b>	<b>2005 (9)</b>	<b>2006 (11)</b>	<b>2007(13)</b>	<b>2008 (11)</b>
Phragmites australis	Phragmites australis	Phragmites australis	Phragmites australis	Phragmites australis	Phragmites australis
Iva frutescens	Iva frutescens	Distichlis spicata	Distichlis spicata	Distichlis spicata	Distichlis spicata
Solidago sempervirens	Pluchea purpurascens	Iva frutescens	Iva frutescens	Iva frutescens	Iva frutescens
Schoenoplectus pungens	Solidago sempervirens	Schoenoplectus robustus	Schoenoplectus robustus	Aster nemoralis	Schoenoplectus pungens
Spartina patens	Schoenoplectus pungens	Pluchea purpurascens	Pluchea purpurascens	Schoenoplectus robustus	Schoenoplectus robustus
Spartina alterniflora	Spartina patens	Schoenoplectus pungens	Symphyotrichum spp.	Pluchea purpurascens	Pluchea purpurascens
	Spartina alterniflora	Spartina patens	Schoenoplectus pungens	Solidago sempervirens	Solidago sempervirens
		Salicornia sp.	Spartina patens	Schoenoplectus pungens	Spartina patens
		Spartina alterniflora	Salicornia sp.	Spartina patens	Eleocharis parvula
			Spartina cynosuroides	Eleocharis parvula	Salicornia spp.
			Spartina alterniflora	Salicornia spp.	Spartina alterniflora
				Spartina alterniflora	
				Algae	

**Table 5-3. Plant species per Area 2003-2008, con't.**

**AREA 3**

<b>2003 (7)</b>	<b>2004 (7)</b>	<b>2005 (10)</b>	<b>2006 (10)</b>	<b>2007 (8)</b>	<b>2008 (10)</b>
Phragmites australis	Phragmites australis	Phragmites australis	Phragmites australis	Phragmites australis	Phragmites australis
Distichlis spicata	Distichlis spicata	Distichlis spicata	Distichlis spicata	Iva frutescens	Distichlis spicata
Iva frutescens	Iva frutescens	Iva frutescens	Iva frutescens	Solidago sempervirens	Iva frutescens
Pluchea purpurascens	Pluchea purpurascens	Schoenoplectus robustus	Pluchea purpurascens	Schoenoplectus pungens	Schoenoplectus pungens
Schoenoplectus pungens	Schoenoplectus pungens	Pluchea purpurascens	Solidago sempervirens	Spartina patens	Schoenoplectus robustus
Spartina patens	Spartina patens	Solidago sempervirens	Schoenoplectus pungens	Salicornia spp.	Solidago sempervirens
Spartina alterniflora	Spartina alterniflora	Schoenoplectus pungens	Spartina patens	Spartina cynosuroides	Spartina patens
		Spartina patens	Salicornia sp.	Spartina alterniflora	Salicornia spp.
		Spartina cynosuroides	Spartina cynosuroides		Spartina cynosuroides
		Spartina alterniflora	Spartina alterniflora		Spartina alterniflora

**AREA 4**

<b>2003 (7)</b>	<b>2004 (7)</b>	<b>2005 (7)</b>	<b>2006 (8)</b>	<b>2007 (8)</b>	<b>2008 (10)</b>
Phragmites australis	Phragmites australis	Phragmites australis	Phragmites australis	Phragmites australis	Phragmites australis
Distichlis spicata	Distichlis spicata	Distichlis spicata	Distichlis spicata	Distichlis spicata	Distichlis spicata
Iva frutescens	Iva frutescens	Iva frutescens	Iva frutescens	Iva frutescens	Iva frutescens
Pluchea purpurascens	Pluchea purpurascens	Schoenoplectus robustus	Schoenoplectus robustus	Schoenoplectus robustus	Schoenoplectus robustus
Schoenoplectus pungens	Schoenoplectus pungens	Pluchea purpurascens	Pluchea purpurascens	Pluchea purpurascens	Pluchea purpurascens
Spartina patens	Spartina patens	Spartina patens	Schoenoplectus pungens	Schoenoplectus pungens	Spartina patens
Spartina alterniflora	Spartina alterniflora	Spartina alterniflora	Spartina patens	Spartina patens	Salicornia spp.
			Spartina alterniflora	Spartina alterniflora	Spartina cynosuroides
					Spartina alterniflora
					Cyperus filicinus



Vegetation community composition was compared between treatments and among the four areas using modified Braun-Blanquet cover estimation classes. These classes are based on ranked percent cover for each species or cover type (James-Pirri et al., 2008). The cover categories used were: 0=0%, 1=<5%, 2=5-25%, 3=26-50%, 4=51-75%, 5=76-100%. Vegetation community composition was similar between treatment and control marshes (ANOSIM, Global R=0.023, p=0.093), but different among the four areas (ANOSIM, Global R=0.093, p=0.00005, Bonferroni adjusted alpha=0.0083). Specifically, Area 1's vegetation community composition significantly differed from those in other areas, which were similar to each other. Refer to Table 5-4.

**Table 5-4. Vegetation Community Comparisons among Four Areas. ANOSIM Global R Statistics and P-values for the Overall Model and for Individual Pairwise Comparisons (in Bold if Significant at Bonferroni Adjusted Alpha < 0.0083) are shown.**

Comparison	Global-R	p-value
<b>Area 1-Area 2</b>	<b>0.215</b>	<b>0.00001</b>
<b>Area 1-Area 3</b>	<b>0.191</b>	<b>0.0002</b>
<b>Area 1-Area 4</b>	<b>0.138</b>	<b>0.001</b>
Area 2-Area 3	-0.022	0.791
Area 2-Area 4	0.049	0.06
Area 3-Area 4	0.032	0.082

Significant differences in vegetation communities were assessed by SIMPER analysis (Table 5-5). Several plant species/cover types contributed approximately 80% of the observed dissimilarity between Area 1 and the remaining areas. Four species, *Spartina alterniflora*, *Schoenoplectus pungens*, *Spartina patens*, and *Distichlis spicata* accounted for approximately 50% of the observed dissimilarity. *S. alterniflora* had smaller percent cover whereas *S. pungens*, *S. patens*, and *D. spicata* had larger percent cover in Area 1 compared to all other areas.

Two additional species with larger percent cover in Area 1 were *Schoenoplectus robustus* and *Solidago sempervirens*, which contributed between 5% and 10% of the observed dissimilarity. These findings suggest that Area 1 had smaller percent cover by low marsh vegetation (i.e., *S. alterniflora*) and larger percent cover by high marsh vegetation due likely to it being the most upland location among all four study areas. Area 1 also appeared to have more diverse high marsh vegetation dominated by *S. patens* with additional plant species also having significantly larger percent cover compared to other areas. Dead and live *Phragmites* contributed about 5% each of the observed dissimilarity. Although Area 1 had larger percent cover by dead *Phragmites* compared to all other areas, and smaller percent cover by live *Phragmites* compared to Areas 3 and 4, these differences were relatively minor suggesting that the contribution to dissimilarity by this species was probably due to a different distribution among plots within each area. Area 1 also had less bare ground than either Area 2 or Area 4.

**Table 5-5. SIMPER Analyses indicating the Contribution of Individual Cover Types to Observed Dissimilarity for Significant Comparisons (Area 1 to all other Areas). Only Species contributing approximately 80% of the Cumulative Dissimilarity are shown. Cover Classes are average modified Braun-Blanquet Scale (0=0%, 1=<5%, 2=5-25%, 3=26-50%, 4=51-75%, 5=76-100%).**

Species/Type	Cover Class %		Cover Class % Area 1 relative to Area N	Cumulative Contribution to Dissimilarity
	Area 1	Area 2		
<i>Spartina alterniflora</i>	0.33	2.63	Less	14.12
<i>Schoenoplectus pungens</i>	1.67	0.71	More	23.28
<i>Schoenoplectus pungens (dead)</i>	1.67	0.33	More	31.72
<i>Spartina patens (dead)</i>	4.67	3.79	More	39.57
<i>Distichlis spicata</i>	1.38	0.13	More	46.69
<i>Bare</i>	0.33	1.13	Less	53.76
<i>Spartina patens</i>	4.79	4.08	More	60.18
<i>Schoenoplectus robustus</i>	0.88	0.29	More	65.17

Species/Type	Cover Class %		Cover Class % Area 1 relative to Area N	Cumulative Contribution to Dissimilarity
<i>Solidago sempervirens</i>	0.79	0.25	More	69.76
<i>Phragmites australis (dead)</i>	0.67	0.42	More	74.16
<i>Distichlis spicata (dead)</i>	0.79	0	More	78.13
<i>Phragmites australis</i>	0.54	0.33	More	81.71
	<b>Area 1</b>	<b>Area 3</b>		
<i>Spartina alterniflora</i>	0.33	2.7	Less	14.47
<i>Schoenoplectus pungens</i>	1.67	0.45	More	23.11
<i>Schoenoplectus pungens (dead)</i>	1.67	0.25	More	31.6
<i>Spartina patens (dead)</i>	4.67	3.6	More	39.64
<i>Distichlis spicata</i>	1.38	0.1	More	47.12
<i>Spartina patens</i>	4.79	4.05	More	52.74
<i>Solidago sempervirens</i>	0.79	0.35	More	58.02
<i>Phragmites australis (dead)</i>	0.67	0.6	More	63.02
<i>Schoenoplectus robustus</i>	0.88	0.1	More	67.76
<i>Spartina alterniflora (dead)</i>	0.29	0.65	Less	72.2
<i>Phragmites australis</i>	0.54	0.55	Less	76.58
<i>Distichlis spicata (dead)</i>	0.79	0	More	80.72
	<b>Area 1</b>	<b>Area 4</b>		
<i>Spartina patens (dead)</i>	4.67	3.6	More	9.11
<i>Schoenoplectus pungens</i>	1.67	0	More	17.76
<i>Schoenoplectus pungens (dead)</i>	1.67	0	More	26.35
<i>Distichlis spicata</i>	1.38	0.7	More	34.29
<i>Spartina patens</i>	4.79	4.05	More	40.95
<i>Spartina alterniflora</i>	0.33	0.9	Less	47.21
<i>Phragmites australis (dead)</i>	0.67	0.6	More	52.75
<i>Spartina alterniflora (dead)</i>	0.29	0.7	Less	58.21
<i>Schoenoplectus robustus</i>	0.88	0.15	More	63.23
<i>Phragmites australis</i>	0.54	0.55	Less	67.93
<i>Bare</i>	0.33	0.6	Less	72.26
<i>Distichlis spicata (dead)</i>	0.79	0	More	76.54
<i>Solidago sempervirens</i>	0.79	0	More	80.78

### 5.3.1.2 Vegetation Biomass

The total above-ground vegetation biomass (dry weight) was compared among the areas and between the treatment and the control groups by nested ANOVA (treatment + area (treatment)). The main effects of treatment statistically significant ( $p < 0.037$ ), with significantly higher total biomass in the treatment areas, while the effect of area was not statistically significant (nested term,  $p = 0.715$ ). Refer to Table 5-6.

**Table 5-6. Average Total Above-ground Biomass (Dry Weight,  $\text{gm}^{-2}$ ) and Standard Deviation**

Area	Total Above-Ground Biomass, $\text{gm}^{-2}$	
	Mean	SD
1	1476.3	529.6
2	1667.8	747.8
3	1165.0	623.2
4	1112.3	382.8

The contribution of dead and live plant material to the total biomass in each area is shown in Figure 5-4. Slightly more live biomass was found in Areas 1 and 2 compared to Areas 3 and 4, whereas the proportion of dead biomass was similar.

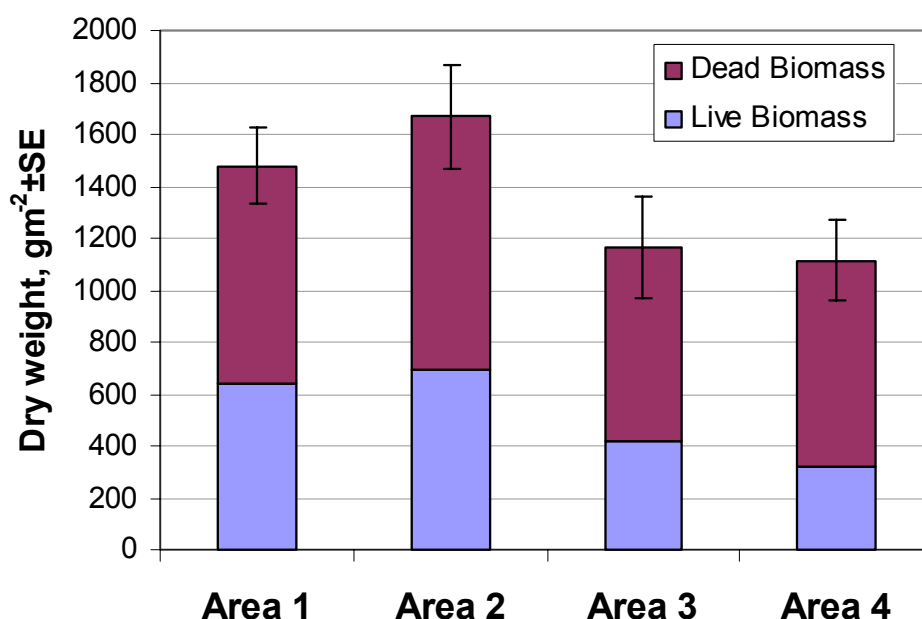


Figure 5-4. Average Above-ground Vegetation Biomass (Mean Dry Weight in  $\text{gm}^{-2} \pm \text{SE}$ ) by Dead and Live Plant Material.

For the below-ground vegetation biomass, core soil monoliths were washed and dried. The dry weight was standardized to the full core length (20cm) and the samples were combined by treatment group to increase statistical power due to a small sample size at each area. The treatment areas had significantly higher below-ground biomass,  $\text{mean} \pm \text{SE} = 34,676 \text{ gm}^{-2} \pm 3,275$ , than did the control areas,  $\text{mean} \pm \text{SE} = 20,519 \text{ gm}^{-2} \pm 2,518$ , two-sample t-test  $t(20) = -3.4$ ,  $p = 0.003$ . See Table 5-7.

**Table 5-7. Average Total Below-ground Biomass (Dry Weight,  $\text{gm}^{-2}$ ) and Standard Deviation**

Area	Total Below-Ground Biomass, $\text{gm}^{-2}$	
	Mean	SD
1	36,277	9,484
2	32,756	13,195
3	25,757	7,769
4	16,154	6,395

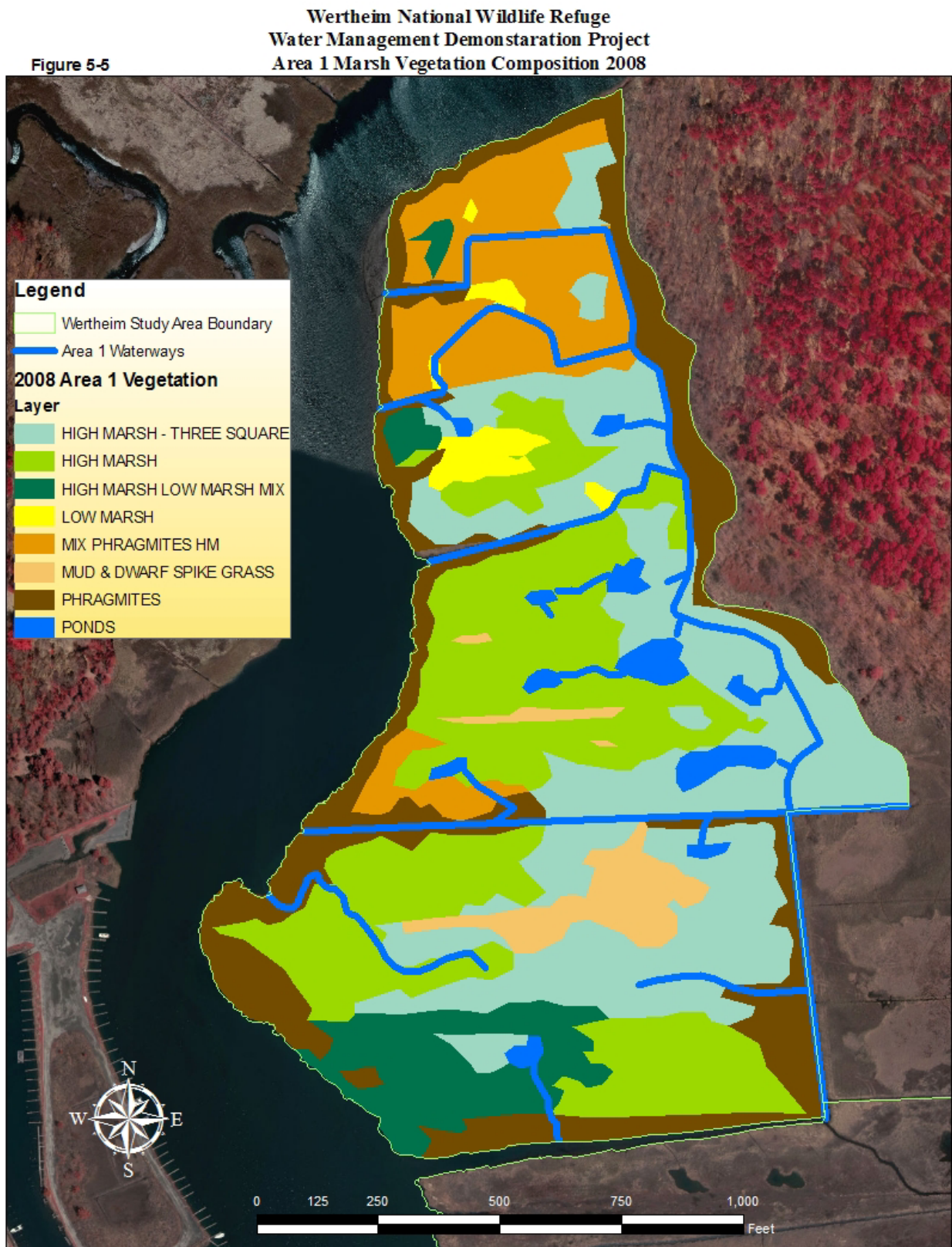


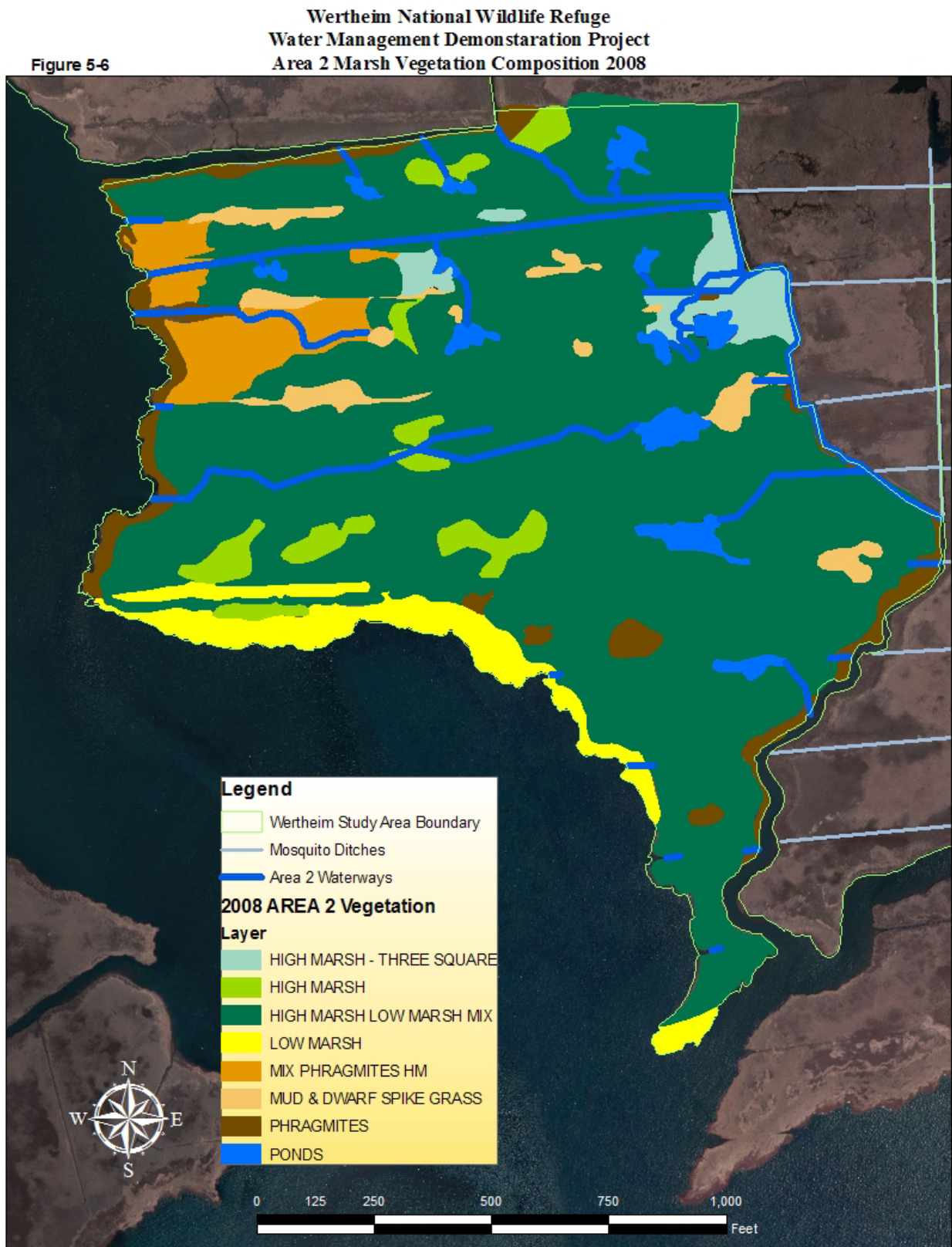
### **5.3.1.3 Marsh Vegetation Composition**

Marsh vegetation maps were delineated based on the aerial photos and ground-truthed and are shown in Figures 5-5, 5-6, 5-7, and 5-8.

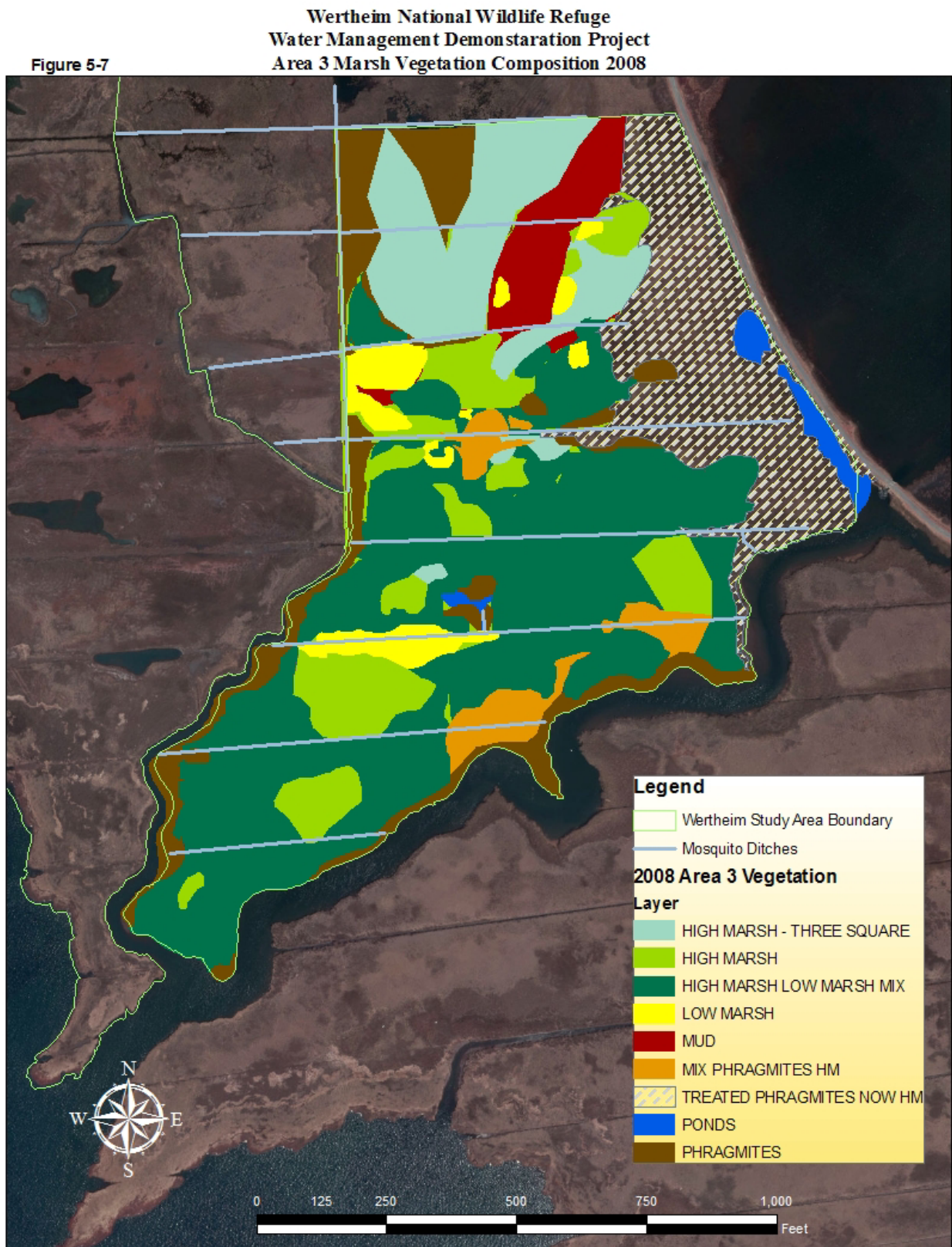
### **5.3.1.4 Vegetation Photographs**

The vegetation photographs (n=4 per each photo station) taken in four cardinal directions are shown in Appendix D.













### 5.3.2. 2004-2008 Mosquito Larval Sampling

#### 5.3.2.1. Mosquito Larval Sampling Overview

A total of 12,946 samples (dips) of mosquito larvae were collected in the four study areas between 2004 and 2008. The sampling effort was fairly uniform across space and time. See Table 5-8.

**Table 5-8. Number of Samples (Dips) taken per Area per Year**

<b>Year</b>	<b>Area 1</b>	<b>Area 2</b>	<b>Area 3</b>	<b>Area 4</b>	<b>Total</b>
<b>2004</b>	658	588	360	418	2024
<b>2005</b>	353	458	339	497	1647
<b>2006</b>	644	950	729	1022	3345
<b>2007</b>	856	823	621	855	3155
<b>2008</b>	723	658	677	717	2775
<b>Total</b>	<b>3234</b>	<b>3477</b>	<b>2726</b>	<b>3509</b>	

Some of the samples were "dry", which means no standing water was present at transects. A sample is "dry" for targeted sampling when a previously identified mosquito larval habitat, usually found wet during the periods when tidal or rain surface water was present, was instead completely drained from the salt marsh. Approximately 49% of the transect samples were dry, significantly higher than approximately 13% of the targeted samples (Chi-square test,  $X^2=1859.9$ ,  $df=2$ ,  $P<0.001$ . See Table 5-9.

**Table 5-9. Proportion of Samples (Dips) containing Water in Transect versus Targeted Sampling**

Samples (Dips)		Water		N/R*	Total
		Yes	No		
<b>Transect</b>	Count	1646	1590	35	3271
	%	50.3	48.6	1.1	
<b>Targeted</b>	Count	8152	1227	296	9675
	%	84.3	12.7	3.1	

\*N/R – not recorded.

Only about 10% of transect samples collected in 2004-2008 with water contained mosquito larvae, which was significantly lower than ~ 27% for targeted sampling (Chi-square test,  $X^2=211.4$ ,  $df=1$ ,  $P<0.001$ ; Table 5-10). Overall, only about 7% of all positive dips came from transect sampling. See Table 5-10.

**Table 5-10. Proportion of Positive Samples (Dips containing Mosquito Larvae) per Samples with Water in Transect versus Targeted Sampling**

Samples (Dips)		Larvae		Total
		Yes	No	
<b>Transect</b>	Count	172	1474	1646
	%	10.4	89.6	
<b>Targeted</b>	Count	2233	5919	8152
	%	27.4	72.6	

Immature stages of 3 mosquito species, *Aedes. sollicitans*, *Aedes. cantator*, and *Culex. salinarius* were collected during the study period. The presence of *Cx. salinarius* in the upper salt marsh was unexpected; thus, the close association of this species with the salt marsh habitat was investigated and further characterized in a peer-reviewed article (Rochlin et al., 2008). Although *Ae. sollicitans* was the most commonly found species in all 4 areas throughout the season, *Cx. salinarius* sometimes

predominated in Area 3 when more permanent brackish water from rain events accumulated on the marsh during this species' peak season from late July through early September.

### 5.3.2.2 Larval Sampling at Transect Stations

The goal of transect sampling protocol is to estimate population levels of mosquito larvae per area. This is a time and labor intensive procedure that requires sufficient number of transects to compensate for the sampling points that fall on dry land, *i.e.*, "no data" in terms of mosquito larval habitat. For this project, only approximately one half of transect sampling points on average were informative, *i.e.*, contained standing water. See Table 5-11.

**Table 5-11. Transect Sampling: Number and Percentage of Sampling Stations that were "Wet" containing Standing Water**

Year	Area	Water			
		Dry		Wet	
		Count	%	Count	%
2004	Area 1	80	40.8	116	59.2
	Area 2	122	62.6	73	37.4
	Area 3	92	57.1	69	42.9
	Area 4	91	63.2	53	36.8
2005	Area 1	47	50.0	47	50.0
	Area 2	64	53.8	55	46.2
	Area 3	35	60.3	23	39.7
	Area 4	35	44.3	44	55.7
2006	Area 1	55	52.4	50	47.6
	Area 2	53	31.7	114	68.3
	Area 3	95	57.2	71	42.8
	Area 4	71	37.4	119	62.6
2007	Area 1	134	63.2	78	36.8
	Area 2	78	36.1	138	63.9
	Area 3	95	54.3	80	45.7
	Area 4	73	41.0	105	59.0

Year	Area	Water			
		Dry		Wet	
		Count	%	Count	%
2008	Area 1	141	68.1	66	31.9
	Area 2	87	40.5	128	59.5
	Area 3	78	43.6	101	56.4
	Area 4	64	35.6	116	64.4
<b>Total</b>		<b>1590</b>	<b>49.1</b>	<b>1646</b>	<b>50.9</b>

BACI comparison of monthly percent wet samples (*i.e.*, containing standing water) pre- and post- modification in control (Areas 3 and 4) and treatment (Areas 1 and 2) areas are shown in Figure 5-9. In both groups, the proportion of wet samples increased (mean $\pm$ SE), from 47.66 $\pm$ 6.49 to 56.84 $\pm$ 3.89 in the control areas, and from 51.36 $\pm$ 5.41 to 52.44 $\pm$ 4.99 in the treatment areas however, greater increase was observed in the control areas.

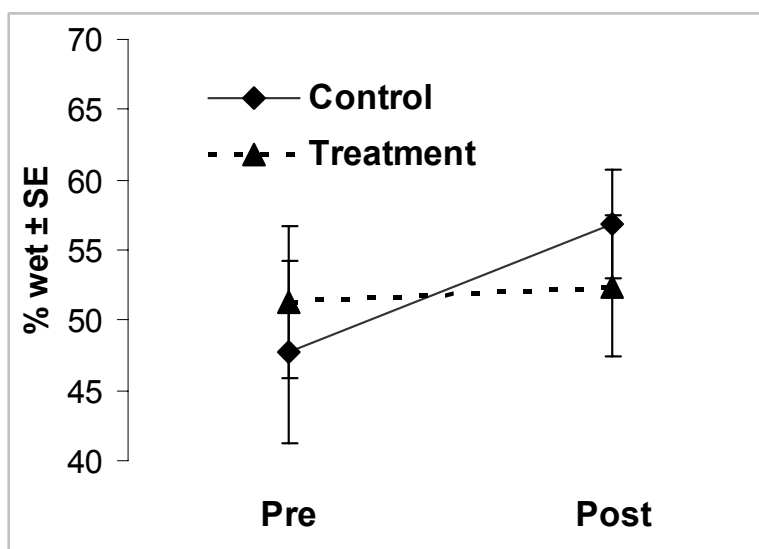


Figure 5-9. Transect Sampling: BACI Comparison of Monthly Percent Wet Samples Pre- and Post- modification in Control (Area 3 and 4) and Treatment (Areas 1 and 2). Pre-modification (Pre): Area 1=2004, Areas 2, 3, 4=2004-05. Post-modification (Post): Area 1=2005-08, Areas 2, 3, 4=2006-08.

Only about 10% of the "wet" sampling stations containing water had mosquito larvae resulting in very low number of "positive" sampling stations during each year and over the study period. See Table 5-12.

**Table 5-12. Transect Sampling: Number and Percentage of "Wet" Sampling Stations that were "Positive", containing Mosquito Larvae**

Year	Area	Larvae			
		Absent		Present	
		Count	%	Count	%
2004	Area 1	102	87.9	14	12.1
	Area 2	60	82.2	13	17.8
	Area 3	50	72.5	19	27.5
	Area 4	32	60.4	21	39.6
2005	Area 1	47	100.0	0	0.0
	Area 2	49	89.1	6	10.9
	Area 3	21	91.3	2	8.7
	Area 4	42	95.5	2	4.5
2006	Area 1	49	98.0	1	2.0
	Area 2	113	99.1	1	0.9
	Area 3	62	87.3	9	12.7
	Area 4	103	86.6	16	13.4
2007	Area 1	78	100.0	0	0.0
	Area 2	121	87.7	17	12.3
	Area 3	72	90.0	8	10.0
	Area 4	90	85.7	15	14.3
2008	Area 1	66	100.0	0	0.0
	Area 2	124	96.9	4	3.1
	Area 3	86	85.1	15	14.9
	Area 4	107	92.2	9	7.8
<b>Total</b>		<b>1474</b>	<b>89.6</b>	<b>172</b>	<b>10.4</b>

BACI comparison of monthly percent positive samples pre- and post-modification in control (Areas 3 and 4) and treatment (Areas 1 and 2) areas is shown in Figure 5-10. In both groups, the proportion of positive samples declined (mean±SE), from 13.85±4.61 to 12.17±2.09 in the



control areas, and from  $11.26 \pm 3.25$  to  $2.28 \pm 0.96$  in the treatment areas, however, a much greater decline was observed in the treatment areas.

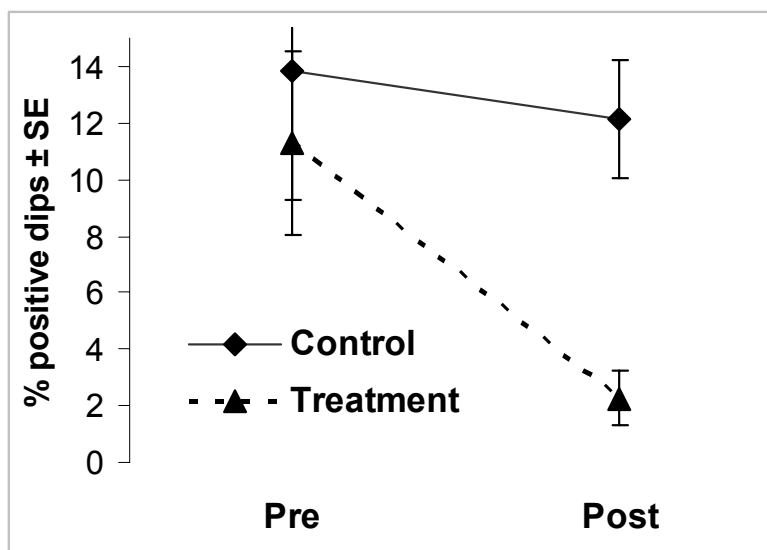


Figure 5-10. Transect Sampling: BACI comparison of monthly percent positive samples pre- and post-modification in control (Areas 3 and 4) and treatment (Areas 1 and 2). Pre-modification (Pre): Area 1=2004, Areas 2, 3, 4=2004-05. Post-modification (Post): Area 1=2005-08, Areas 2, 3, 4=2006-08.

Although highly variable and not a true estimate of larval population level, the number of larvae per dip was also determined. Monthly mean and standard deviation (SD) of number of larvae per dip controlled for water presence are shown in Table 5-13.

**Table 5-13. Transect Sampling: Monthly Mean and Standard Deviation of Number of Larvae per Dip**

Year	Area	Area Status	Larvae Per Dip	
		Pre/Post/Control	Mean	SD
2004	Area 1	Pre	0.96	1.19
	Area 2	Pre	1.23	1.61
	Area 3	Control	1.93	2.53
	Area 4	Control	2.28	2.94

Year	Area	Area Status	Larvae Per Dip	
		Pre/Post/Control	Mean	SD
2005	Area 1	Post	none	
	Area 2	Pre	1.42	1.95
	Area 3	Control	0.25	0.50
	Area 4	Control	0.24	0.53
2006	Area 1	Post	0.09	0.18
	Area 2	Post	0.01	0.01
	Area 3	Control	0.33	0.38
	Area 4	Control	0.32	0.52
2007	Area 1	Post	none	
	Area 2	Post	0.48	0.63
	Area 3	Control	1.07	2.00
	Area 4	Control	0.38	0.33
2008	Area 1	Post	none	
	Area 2	Post	0.07	0.17
	Area 3	Control	0.34	0.23
	Area 4	Control	0.19	0.26

BACI comparison of number of larvae per dip pre- and post- modification in control (Areas 3 and 4) and treatment (Areas 1 and 2) areas is shown in Figure 5-11. In both groups, the number of larvae per dip (mean±SE) declined, from 1.16±0.48 to 0.43±0.15 in the control areas, and from 1.19±0.37 to 0.1±0.05 in the treatment areas, however, a greater decline was observed in treatment areas.

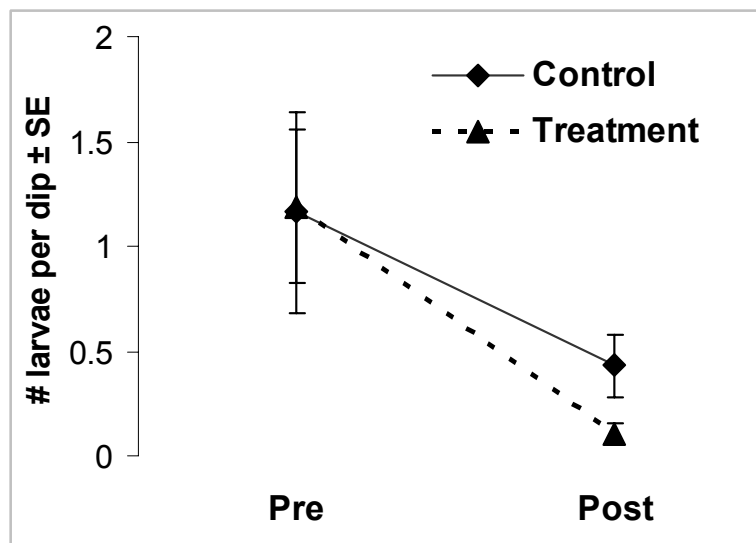


Figure 5-11. Transect Sampling: BACI Comparison of Average Monthly Number of Larvae per Dip Pre- and Post- modification in Control (Areas 3 and 4) and Treatment (Areas 1 and 2). Pre-modification (Pre): Area 1=2004, Areas 2, 3, 4=2004-05. Post-modification (Post): Area 1=2005-08, Areas 2, 3, 4=2006-08.

### 5.3.2.3 Targeted Larval Sampling

Routine surveillance by mosquito control professionals is based on targeted larval sampling. The goals of targeted sampling protocol were to determine the geographic extent of the actual mosquito larval habitat and to quantify mosquito breeding intensity. Thus, the targeted larval surveys intended to be comprehensive by sampling most or all larval habitat across each study area. Sites previously determined to be larval habitat were revisited to determine if they still supported breeding; if those sites were dry, the point was recorded as a "dry" sample. On some occasions, the entire marsh surface was dry with no standing water suitable for mosquito habitat. In such cases, previously detected larval habitat was surveyed and the samples labeled "dry" to demonstrate the extent of the sampling effort. About 87% of all the targeted sampling points were informative, *i.e.*, contained standing water. See Table 5-14.

**Table 5-14. Targeted Sampling: Number and Percentage of Sampling Stations that were "Wet", containing Standing Water**

Year	Area	Water			
		Dry		Wet	
		Count	%	Count	%
2004	Area 1	45	10.8	372	89.2
	Area 2	29	8.0	332	92.0
	Area 3	8	4.4	174	95.6
	Area 4	12	4.7	243	95.3
2005	Area 1	49	20.2	193	79.8
	Area 2	67	24.1	211	75.9
	Area 3	68	27.2	182	72.8
	Area 4	114	30.8	256	69.2
2006	Area 1	39	7.3	494	92.7
	Area 2	44	5.7	726	94.3
	Area 3	19	3.4	533	96.6
	Area 4	33	4.0	790	96.0
2007	Area 1	132	20.6	508	79.4
	Area 2	93	15.4	509	84.6
	Area 3	90	20.2	355	79.8
	Area 4	106	15.7	569	84.3
2008	Area 1	96	19.0	410	81.0
	Area 2	33	7.4	410	92.6
	Area 3	101	20.3	397	79.7
	Area 4	49	9.1	488	90.9
<b>Total</b>		<b>1227</b>	<b>13.1</b>	<b>8152</b>	<b>86.9</b>

BACI comparison of weekly percent wet samples (*i.e.*, containing standing water) pre- and post- modification in control (Areas 3 and 4) and treatment (Areas 1 and 2) areas are shown in Figure 5-12. In the control areas, the proportion of wet samples increased slightly (mean±SE), from 84.81±3.87 to 85.57±2.13, whereas a slight decrease, from 88.95±3.25 to 83.80±1.99, occurred in the treatment areas. About 27% of the "wet" sampling stations containing water also had mosquito larvae. See Table 5-15.

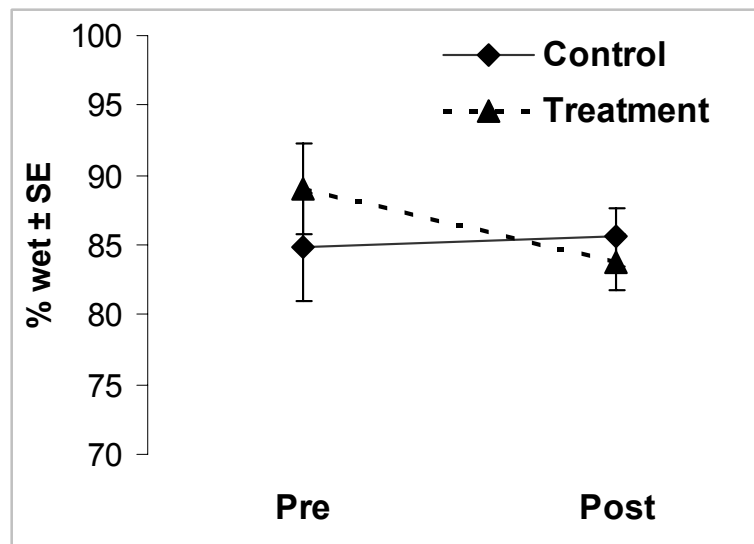


Figure 5-12. Targeted Sampling: BACI Comparison of Weekly Percent Wet Samples Pre- and Post-modification in Control (Areas 3 and 4) and Treatment (Areas 1 and 2). Pre-modification (Pre): Area 1=2004, Areas 2, 3, 4=2004-05. Post-modification (Post): Area 1=2005-08, Areas 2, 3, 4=2006-08.

**Table 5-15. Targeted Sampling: Number and Percentage of "Wet" Sampling Stations that were "Positive", containing Mosquito Larvae**

Year	Area	Larvae			
		Absent		Present	
		Count	%	Count	%
2004	Area 1	190	51.1	182	48.9
	Area 2	195	58.7	137	41.3
	Area 3	79	45.4	95	54.6
	Area 4	147	60.5	96	39.5
2005	Area 1	182	94.3	11	5.7
	Area 2	116	55.0	95	45.0
	Area 3	108	59.3	74	40.7
	Area 4	151	59.0	105	41.0
2006	Area 1	436	88.3	58	11.7
	Area 2	621	85.5	105	14.5
	Area 3	272	51.0	261	49.0
	Area 4	505	63.9	285	36.1

Year	Area	Larvae			
		Absent		Present	
		Count	%	Count	%
2007	Area 1	485	95.5	23	4.5
	Area 2	418	82.1	91	17.9
	Area 3	246	69.3	109	30.7
	Area 4	345	60.6	224	39.4
2008	Area 1	376	91.7	34	8.3
	Area 2	355	86.6	55	13.4
	Area 3	306	77.1	91	22.9
	Area 4	386	79.1	102	20.9
<b>Total</b>		<b>5919</b>	<b>72.6</b>	<b>2233</b>	<b>27.4</b>

BACI comparison of weekly percent positive samples pre- and post-modification in control (Areas 3 and 4) and treatment (Areas 1 and 2) areas is shown in Figure 5-12. In both groups, the proportion of positive samples declined (mean $\pm$ SE), from 37.75 $\pm$ 4.79 to 31.34 $\pm$ 2.49 in the control areas, and from 38.87 $\pm$ 5.44 to 8.84 $\pm$ 1.30 in the treatment areas, however, a much greater decline was observed in treatment areas.

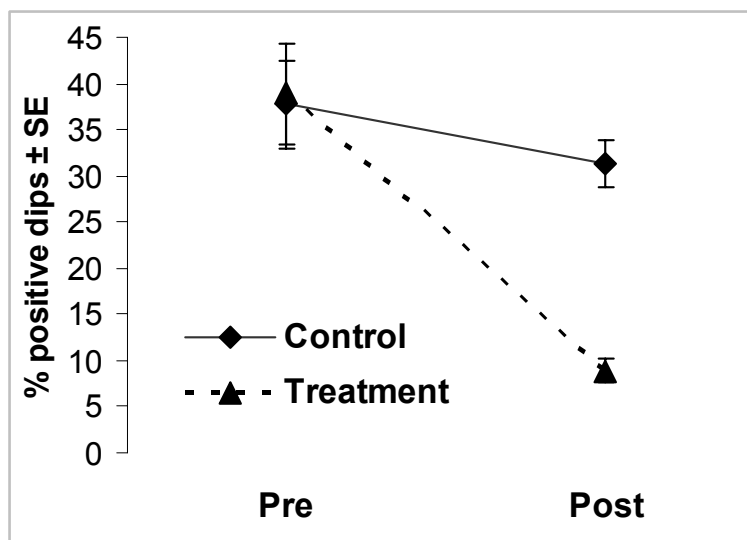


Figure 5-13. Targeted Sampling: BACI Comparison of Weekly Percent Positive Samples Pre- and Post- modification in Control (Areas 3 and 4) and Treatment (Areas 1 and 2). Pre-modification (Pre): Area 1=2004, Areas 2, 3, 4=2004-05. Post-modification (Post): Area 1=2005-08, Areas 2, 3, 4=2006-08.



Although highly variable and not a true estimate of larval population level, the number of larvae per dip was also determined. Weekly mean and Standard Deviation of number of larvae per dip controlled for water presence are shown in Table 5-16.

**Table 5-16. Targeted sampling, weekly mean and Standard Deviation of Number of Larvae per Dip**

Year	Area	Area Status	Larvae Per Dip	
		Pre/Post/Control	Mean	SD
2004	Area 1	Pre	7.43	8.07
	Area 2	Pre	4.82	6.91
	Area 3	Control	10.50	18.83
	Area 4	Control	6.74	8.10
2005	Area 1	Post	0.13	0.40
	Area 2	Pre	2.90	4.62
	Area 3	Control	2.55	2.65
	Area 4	Control	1.06	1.54
2006	Area 1	Post	0.51	1.10
	Area 2	Post	0.88	1.43
	Area 3	Control	5.24	5.96
	Area 4	Control	3.36	3.54
2007	Area 1	Post	0.38	1.14
	Area 2	Post	1.37	2.64
	Area 3	Control	2.10	3.21
	Area 4	Control	3.01	4.29
2008	Area 1	Post	0.59	1.59
	Area 2	Post	0.55	0.93
	Area 3	Control	1.37	2.85
	Area 4	Control	1.09	1.92

BACI comparison of number of larvae per dip pre- and post- modification in control (Areas 3 and 4) and treatment (Areas 1 and 2) areas is shown in Figure 5-14. In both groups, the number of larvae per dip (mean±SE) declined, from 4.11±1.26 to 2.67±0.37 in the control areas, and from

4.57±1.05 to 0.64±0.13 in the treatment areas, however, a significantly greater decline was observed in treatment areas.

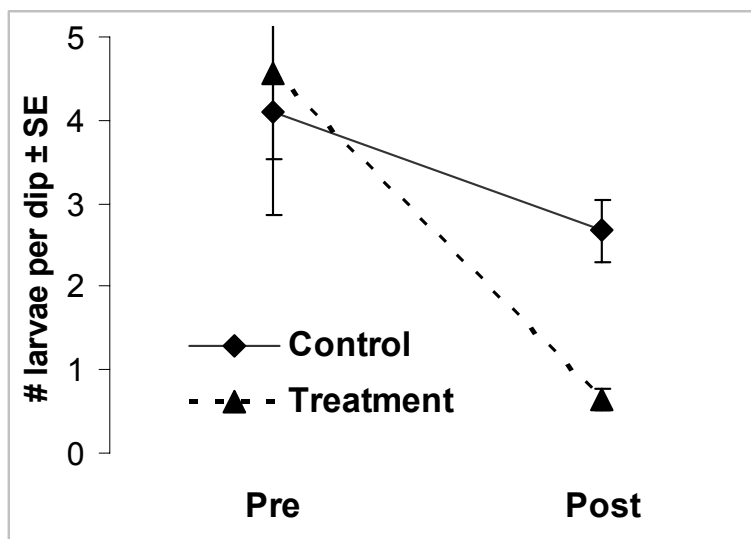


Figure 5-14. Targeted Sampling: BACI Comparison of Average Weekly Number of Larvae per Dip Pre- and Post- modification in Control (Areas 3 and 4) and Treatment (Areas 1 and 2). Pre-modification (Pre): Area 1=2004, Areas 2, 3, 4=2004-05. Post-modification (Post): Area 1=2005-08, Areas 2, 3, 4=2006-08.

#### 5.3.2.4 Geographic Distribution of 2008 Larval Samples

The geographic locations of transect and targeted samples (combined) for each area in 2008 are shown in Figures 5-15 through 5-18. Both negative (no larvae, wet or dry) and positive (with larvae) samples are indicated.

#### 5.3.2.5 Analysis of Residual Larval Habitat in Areas 1 and 2 Post-Modification

Despite significant reduction in the frequency of positive dips within the treatment Areas 1 and 2 (Area 1 and 2), some residual breeding continued post-project. It was noted that the topsoil covering some of the filled ditches formed a slightly concave surface due to settling creating potholes suitable for mosquito larvae. Visual examination of the distribution map of positive dips post-modification compared to that pre-modification confirmed this assertion. Refer to Figure 5-18. Before the ditches were

filled to restore the marsh surface, only a minute proportion of positive dips (about 2%) were found within ~15 feet (5 m) of these ditches compared to just under one-third (~27%) of the total after filling-in. Refer to Table 5-17. Only about 17% of the total positive samples were collected within ~ 60 feet (15 m) from these ditches pre-project compared to ~60% post-project. These differences were statistically significant (Chi-square test,  $X^2=182.6$ ,  $df=2$ ,  $P<0.001$ ) and suggested filled in ditches as the main residual habitat for mosquito larvae post-modification. However, it should be noted that mosquito larvae were mostly found in only 3 out of 19 filled in ditches. Out of 12,687 linear feet total of filled ditches, approximately 2,740 linear feet or ~21.6% supported larval habitat.

**Table 5-17. Number of Positive Dips as a function of Distance to Fill in Mosquito Ditches Before and After the Intervention**  
 Standardized Residual (Significant if > 2.0 or <-2.0, bold letters) is indicated

Treatment		Distance to filled ditch, m		
		5	5-15	>15
<b>Before</b>	Count	10	66	371
	%	2.2	14.8	83.0
	Std. Residual	<b>-6.6</b>	<b>-3.7</b>	<b>5.4</b>
<b>After</b>	Count	107	131	161
	%	26.8	32.8	40.4
	Std. Residual	<b>7.0</b>	<b>4.0</b>	<b>-5.7</b>

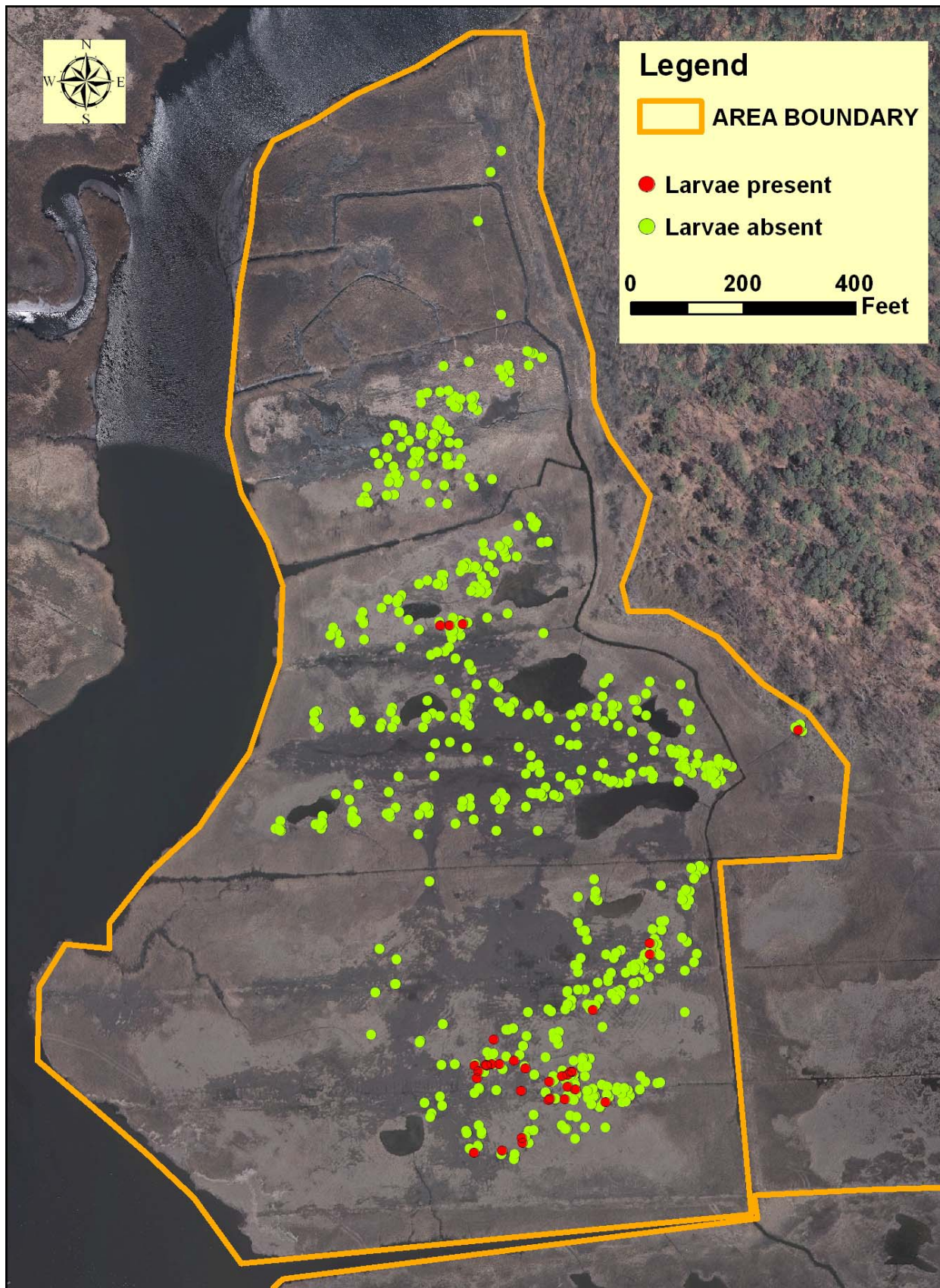


Figure 5-15. Area 1: Geographic Locations of Mosquito Larval Samples (Transect and Targeted Combined) in 2008.



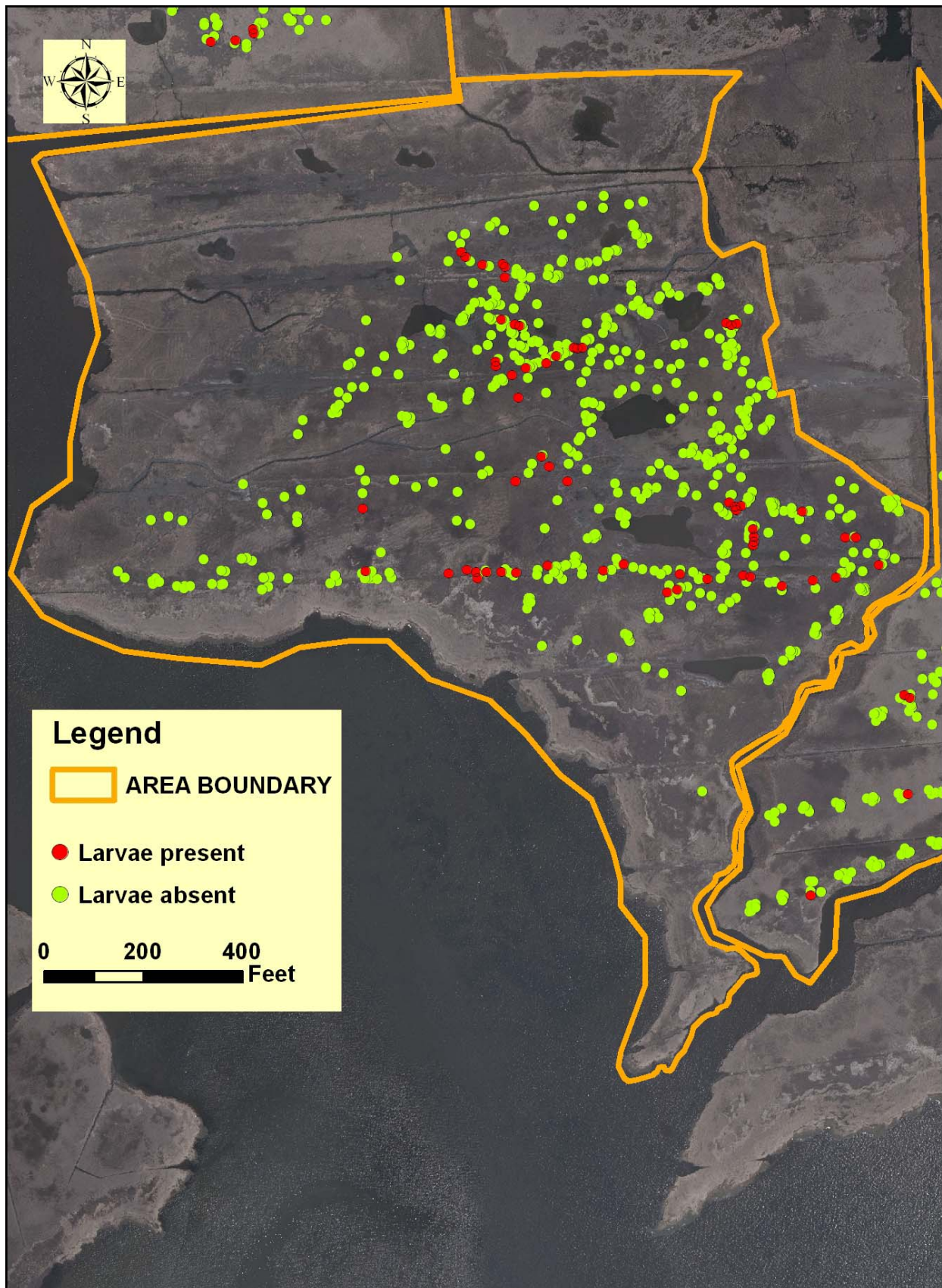


Figure 5-16. Area 2: Geographic Locations of Mosquito Larval Samples (Transect and Targeted Combined) in 2008.



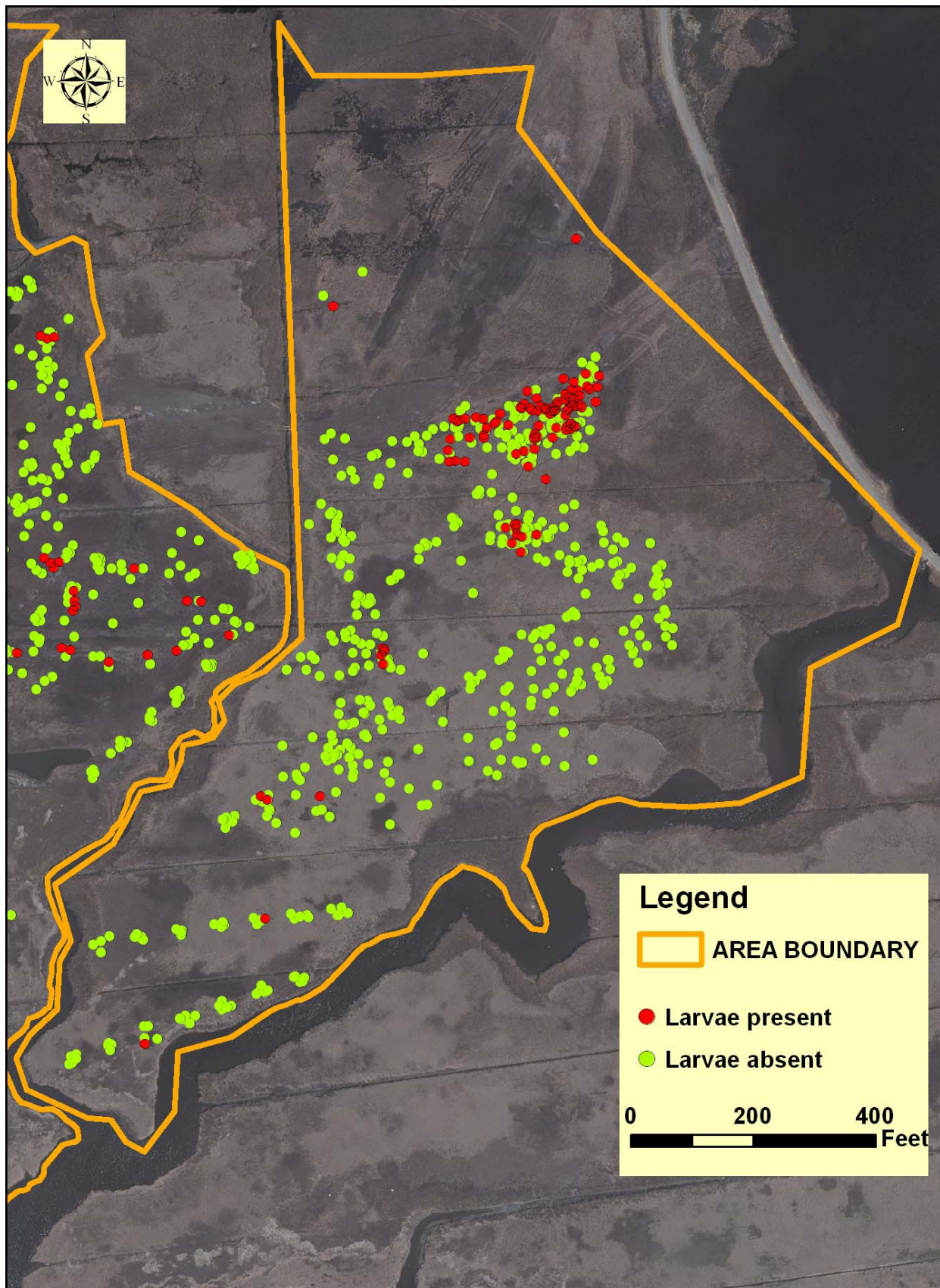


Figure 5-17. Area 3: Geographic Locations of Mosquito Larval Samples (Transect and Targeted Combined) in 2008.



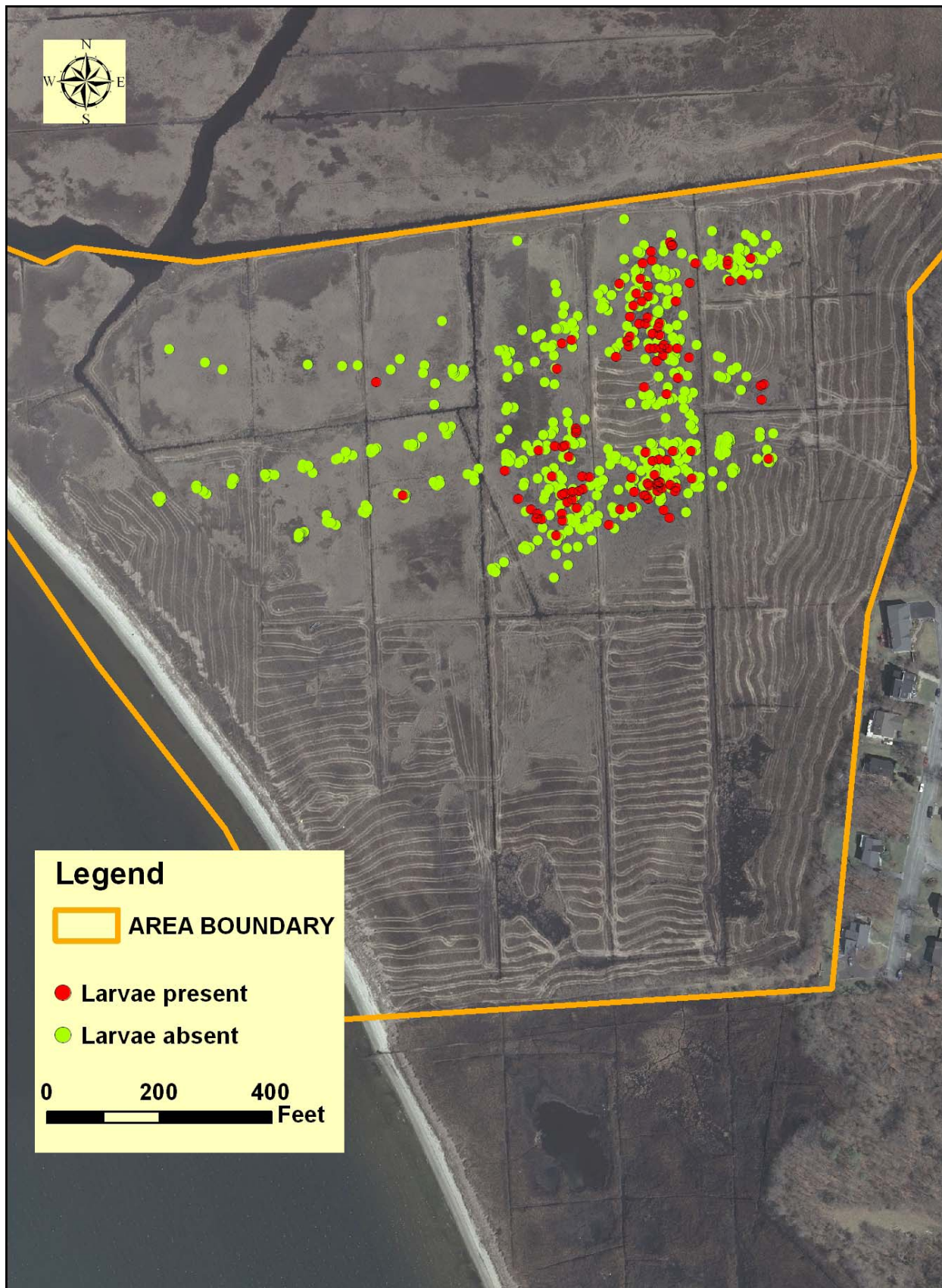


Figure 5-18. Area 4: Geographic Locations of Mosquito Larval Samples (Transect and Targeted Combined) in 2008.



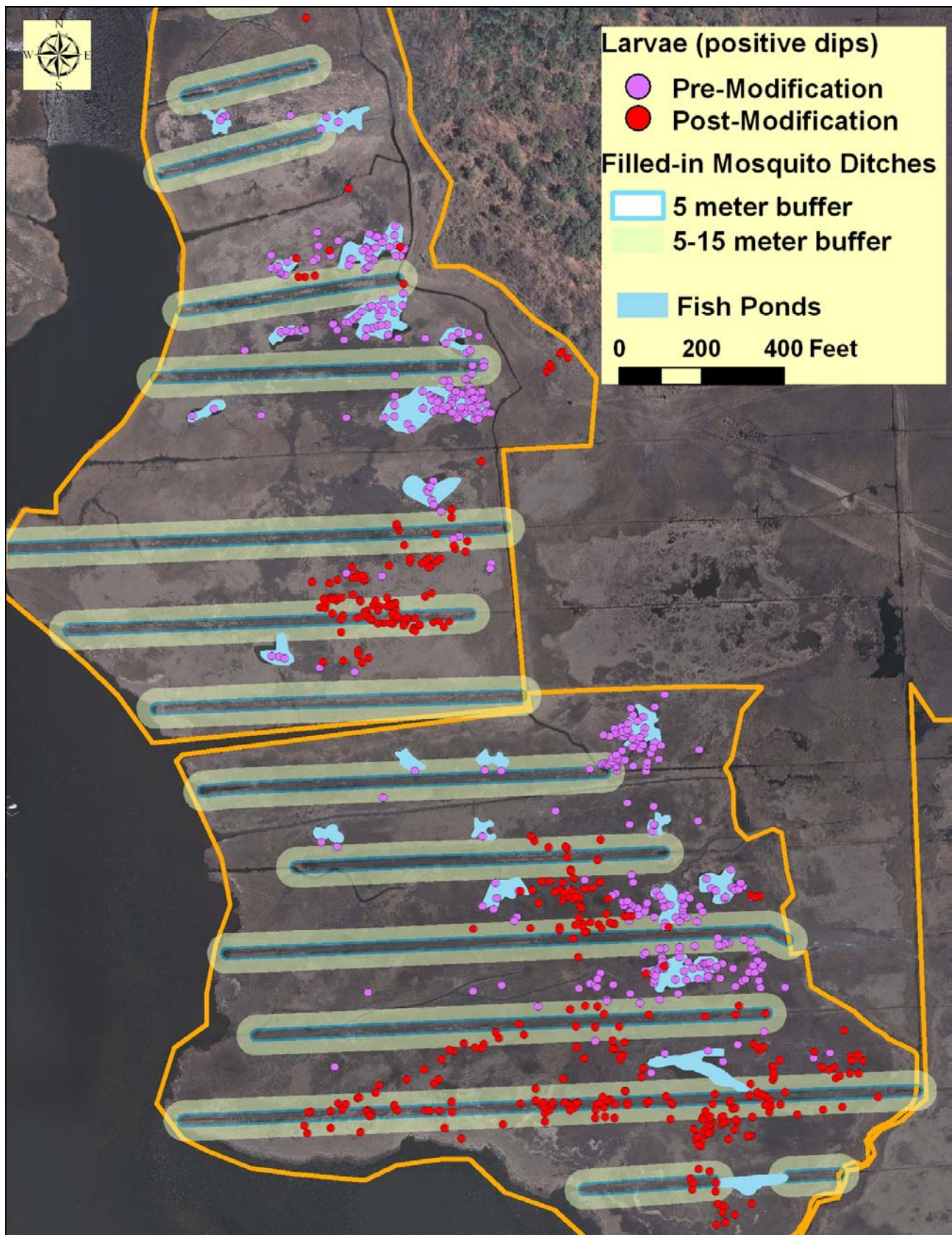


Figure 5-19. Residual Mosquito Larval Habitat in Areas 1 and 2. Pre-modification: Area 1= 2004, Area 2 = 2004-05. Post-modification: Area 1= 2005-08, Area 2 = 2006-08.

### 5.3.2.6 Larvicide Applications

The main objective of the OMWM component in the Wertheim project was to reduce the number of larvicide applications. An existing routine mosquito control program continued throughout the study period using the standard criteria set by USFWS. At least twenty-five (25) samples were required from each area. The area had to meet a minimum treatment threshold of 0.2 larvae per dip before treatment could occur. Other considerations are used to determine if treatment was necessary. These included the extent of the infested area (*i.e.*, total number of positive dips), weather, and environmental conditions directly affecting mosquito larval habitat such as marsh flooding. Even if the numerical threshold was met, the site was not treated if the other factors indicated the larvae were unlikely to emerge in significant numbers. Prior to 2004, Areas 1, 2, and 3 were in one treatment area, and Area 4 was part of another; after 2004 each area was considered to be its own spray block. The total number of pesticide applications in 2001-2008 is shown in Table 5-18.

**Table 5-18. Total Number of Larvicide Applications in 2001-2008**  
**Post-project Values (Treatment Areas) are indicated in Bold Letters**

<b>Year</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>
<b>Area 1</b>	12	8	10	9	<b>1</b>	<b>2</b>	<b>1</b>	<b>3</b>
<b>Area 2</b>	12	8	10	9	5	<b>4</b>	<b>4</b>	<b>3</b>
<b>Area 3</b>	12	8	10	9	5	13	7	8
<b>Area 4</b>	14	7	14	9	7	13	11	8

BACI comparison was carried out to determine before and after treatment effect according to published guidelines for BACI designs (Smith et al., 1993). The differences between control and treatment sites are based on the average number of larvicide applications per month compared pre and post intervention. The number of larvicide applications per month within

the treatment areas pre-treatment (mean $\pm$ SE),  $M=1.95\pm0.20$ , was reduced by approximately 74% to  $M=0.51\pm0.10$  post-treatment, while the number of applications remained similar for the control areas,  $M=2.08\pm0.20$  and  $M=1.80\pm0.19$  pre and post treatment, respectively. The treatment-control difference was significantly higher following the intervention (Mann-Whitney U = 61.0,  $P<0.001$ ) indicating a statistically significant reduction in the number of larvicide applications. See Figure 5-20.

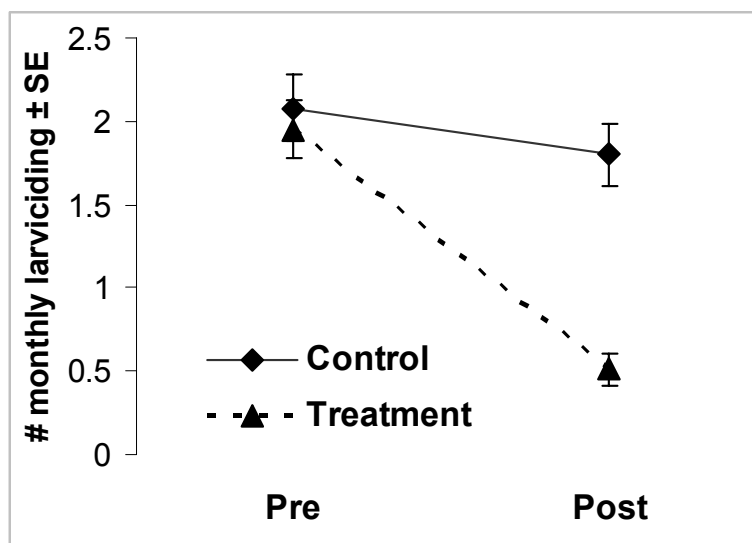


Figure 5-20. BACI Comparison of Average Monthly Number of Larvicide Applications Pre- and Post-modification in Control (Areas 3 and 4) and Treatment (Areas 1 and 2). Pre-modification (Pre): Year 2001-04. Post-modification (Post): Year 2005, Treatment Area 1 only (Area 2 omitted); Year 2006-08, Treatment Areas 1 and 2.

### 5.3.3 2003-2008 Nekton Overview

The number of nekton species and the total number of nekton samples collected from 2003-2008 are summarized in Table 5-19. The nekton species abundance for samples collected from 2003-2008 is summarized in Table 5-20.

**Table 5-19. Nekton Sampling Summary by Area, 2003-2008**

Area	Year	Species Caught	Total Caught	Comments
1	2003	2	49	Sampled once
	2004	3	27	
	2005	9	375	
	2006	8	745	
	2007	7	439	
	2008	7	385	
2	2003	4	164	Sampled once
	2004	4	444	
	2005	5	259	
	2006	7	695	
	2007	8	621	
	2008	8	203	
3	2003	3	144	Sampled once
	2004	3	182	
	2005	7	380	
	2006	5	155	
	2007	5	474	
	2008	6	242	
4	2003	4	116	Sampled once
	2004	6	332	
	2005	6	151	
	2006	5	58	
	2007	5	94	
	2008	6	147	
Total	2003	5	473	
	2004	8	985	
	2005	10	1165	
	2006	9	1653	
	2007	9	1628	
	2008	10	977	

**Table 5-20. Total Nekton Abundance (Number collected for each Taxa), 2003-2008**

Year	Area	<i>Anguilla rostrata</i>	<i>Apeltes quadracus</i>	<i>Callinectes sapidus</i>	<i>Cyprinodon variegatus</i>	<i>Fundulus diaphanous</i>	<i>Fundulus heteroclitus</i>	<i>Fundulus luciae</i>	<i>Lucania parva</i>	<i>Menidia spp.</i>	<i>Palaemonetes spp.</i>	<i>infundibulum</i>	<i>Pungitius pungitius</i>	Juvenile Unknown	TOTAL NEKTON
2003 *	1	-	-	-	-	-	6	-	43	-	-	-	-	-	49
	2	-	-	-	2	-	75	-	18	-	69	-	-	-	164
	3	-	-	-	-	-	45	-	30	-	69	-	-	-	144
	4	-	-	-	-	-	20	-	6	-	89	-	1	-	116
2004	1	-	2	-	-	-	5	-	20	-	-	-	-	-	27
	2	-	-	2	-	-	201	-	123	-	111	-	-	7	444
	3	-	-	-	-	-	89	-	39	-	54	-	-	-	182
	4	-	-	-	-	-	125	1	11	1	192	-	1	1	332
2005	1	5	1	1	50	-	132	1	35	31	96	-	-	23	375
	2	-	-	-	-	1	81	2	28	-	146	-	-	1	259
	3	1	-	-	4	-	189	13	55	2	111	-	-	5	380
	4	-	-	-	5	-	86	2	20	1	33	-	-	4	151
2006	1	2	2	3	238	-	335	-	14	1	145	-	-	5	745
	2	-	-	5	48	-	409	-	6	46	177	4	-	-	695
	3	-	-	4	11	-	23	-	24	-	89	-	-	4	155
	4	-	1	-	2	-	10	-	34	-	11	-	-	-	58
2007	1	5	-	-	102	-	282	2	9	5	34	-	-	-	439
	2	-	-	2	128	-	379	17	2	73	15	1	-	4	621
	3	-	-	-	13	-	210	-	159	15	77	-	-	-	474
	4	-	-	2	1	-	44	-	37	-	10	-	-	-	94
2008	1	6	-	-	84	-	280	2	7	4	2	-	-	3	388
	2	1	-	3	30	1	81	-	10	59	18	-	-	5	208
	3	1	2	-	39	-	144	-	13	-	43	-	-	8	250
	4	1	-	-	-	-	119	7	17	1	2	-	-	1	148

\* All areas sampled once

### 5.3.3.1 2008 Nekton Average Density

Average density per m<sup>2</sup> was computed and log(X+1) transformed to normalize the distribution and to dissociate the variance and the mean.



Nested ANOVA (treatment+ area(treatment)) was used to determine the main effects of treatment and area controlled for treatment. Both were non-significant (treatment term,  $p=0.265$ , nested term  $p=0.530$ ) suggesting that there was no difference between treatment and control areas, as well as among the 4 areas. See Table 5-21. To account for potential confounding effect of dissolved oxygen (DO), it was entered in the model as a covariate. The DO covariate was not significantly different between treatment and among the four areas (ANCOVA  $p=0.863$ ).

**Table 5-21. Average Nekton Density (untransformed) per m<sup>2</sup> and Standard Deviation**

Area	Density	
	Mean	SD
1	17.88	35.01
2	8.99	13.77
3	14.55	33.89
4	7.87	13.53

### 5.3.3.2 2008 Nekton Species richness

Shannon Index was used to compare nekton species richness between treatment and control areas. The distribution could not be normalized by transformations; therefore, non-parametric tests were used on untransformed values. Species richness in treatment areas ( $M=0.43$ ) was significantly higher than that for control areas ( $M=0.21$ ), Mann-Whitney  $U=678.5$ ,  $p=0.009$ . Species richness did not differ significantly among the four areas, Kruskal-Wallis  $X^2=6.8$ ,  $df=3$ ,  $p=0.078$ . These findings were confirmed by nested ANOVA (treatment+ area(treatment)) on ranked data, with the main effects of treatment statistically significant ( $p<0.001$ ), and the effect of area not statistically significant (nested term,  $p=0.996$ ). See Table 5-22.

**Table 5-22. Average Shannon Species Richness Index (Untransformed) and Standard Deviation**

Area	Shannon Index	
	Mean	SD
1	0.44	0.40
2	0.41	0.40
3	0.22	0.36
4	0.21	0.34

### 5.3.3.3 2008 Size of Dominant Nekton

Two dominant nekton species, *Fundulus heteroclitus* and *Cyprinodon variegates*, represented 62.8% and 15.4% of the total, respectively. None of the other species found exceeded 7% of the total. Body size values were square root transformed if needed to normalize the distribution (for *Fundulus heteroclitus*) and compared using nested ANOVA for the main effects of treatment, area (nested within treatment), and each sampling station (nested within area(treatment)).

For *Fundulus heteroclitus* body size, the main effects of treatment and area were not significant ( $p=0.114$  and  $p=0.361$ , respectively), while the main effect of sampling station was significant ( $p<0.001$ ) suggesting that the variability among different stations within each area or treatment type was greater than the variability among different areas or between treatment and control. See Table 5-23.

**Table 5-23. Average *Fundulus heteroclitus* Body Size (Untransformed) and Standard Deviation**

Area	Body size, mm	
	Mean	SD
1	35.5	14.7
2	32.2	11.0
3	25.3	8.5
4	23.5	10.8

For *Cyprinodon variegates* body size, the main effects of treatment and area were not significant ( $p=0.761$  and  $p=0.519$ , respectively), while the main effect of sampling station was significant ( $p<0.001$ ) suggesting that the variability among different stations within each area or treatment type was greater than the variability among different areas or between treatment and control. See Table 5-24.

**Table 5-24. Average *Cyprinodon variegates* Body Size and Standard Deviation.**

Area	Body size, mm	
	Mean	SD
1	30.1	6.5
2	29.3	6.5
3	36.9	9.4
4	NC	

NC-not collected

#### 5.3.3.4 2008 Nekton Community Composition

Examination of nekton community composition indicated that overall, *Fundulus heteroclitus* was the dominant species at all sites, followed by *Cyprinodon variegates*, however, this species was not found in Area 4 (Figure 5-21). Other species were better represented in one or two areas, e.g. *Menidia* spp. in Area 2, *Palaemonetes* spp. in Areas 2 and 3, and

*Fundulus luciae* in Area 4. Overall, the nekton community did not differ among the areas in terms of density (ANOSIM,  $R=0.025$ ,  $p=0.066$ , Bonferroni adjusted alpha =0.0083) or percent species composition (ANOSIM,  $R=0.031$ ,  $p=0.029$ , Bonferroni adjusted alpha =0.0083). Similarly, the nekton community did not differ between the treatment and the control marshes in terms of density (ANOSIM,  $R=0.013$ ,  $p=0.124$ ) or percent species composition (ANOSIM,  $R=0.014$ ,  $p=0.103$ ). The abundance of the most dominant species, *Fundulus heteroclitus*, also did not differ among the four areas (ANOSIM,  $R=0.004$ ,  $p=0.32$ , Bonferroni adjusted alpha =0.0083).

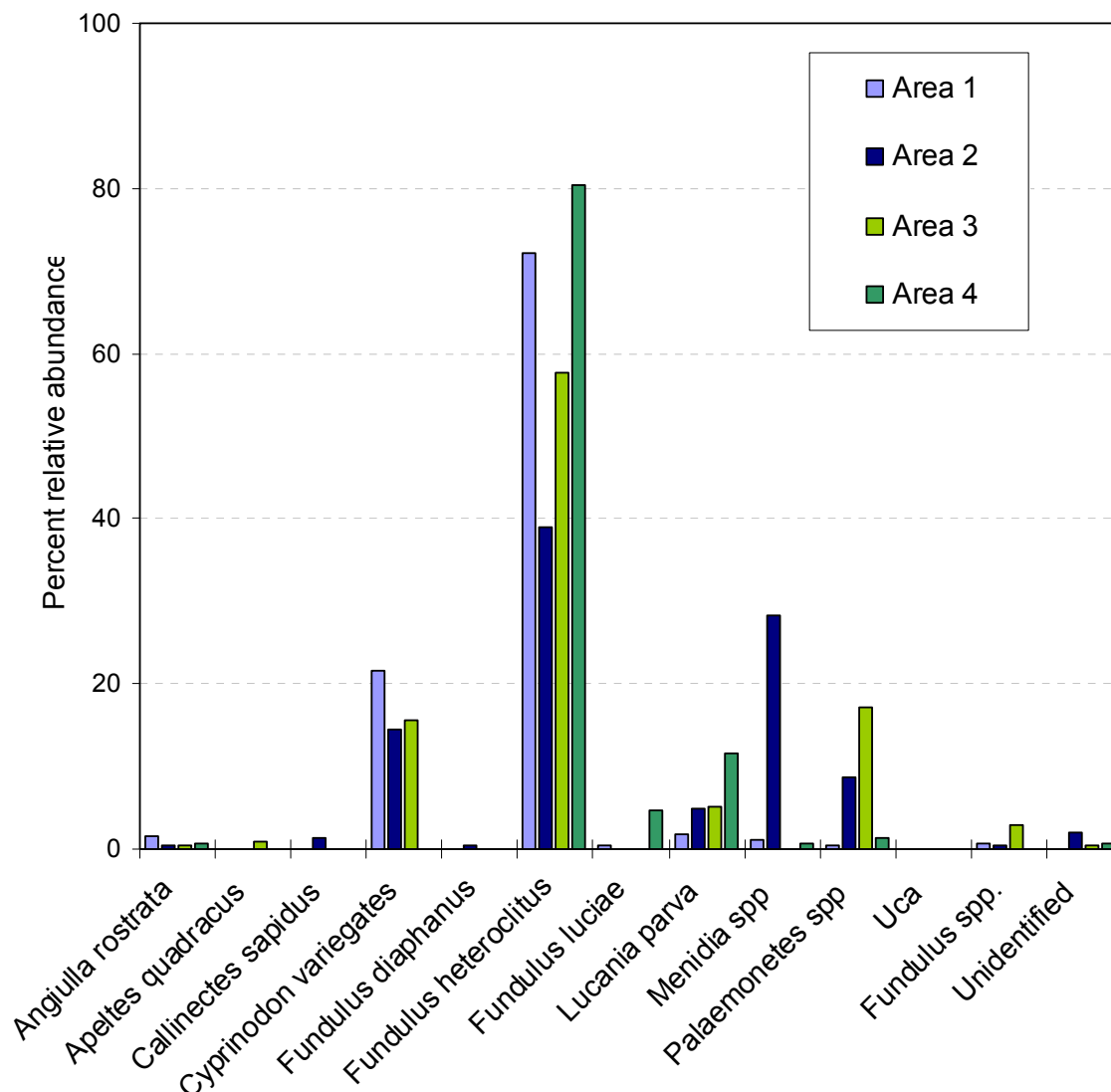


Figure 5-21. Nekton Community Composition

### 5.3.4 2004 - 2008 Birds

The Wertheim marsh lies along migration corridors used by many shorebirds, raptors and songbirds. In addition, the refuge supports nine Federal and/or New York State designated endangered/threatened avian species. Diversity (total number) of bird species encountered in each Area varied each year (Table 5-25), with a large jump in the number of species found in Area 4 during 2008. This is most likely attributed to the Phragmites control program USFWS initiated there in late 2007-2008 that included herbicide application and mowing of dense Phragmites stands within Area 4 (See the Report Addendum for details on the Phragmites control program).

**Table 5-25. Bird Species Diversity – Summer Monitoring**

<i>Area</i>	<i>Summer 2004</i>	<i>Summer 2005</i>	<i>Summer 2006</i>	<i>Summer 2007</i>	<i>Summer 2008</i>
1	11	33	12	17	23
2	7	13	12	18	18
3	8	10	6	13	15
4	15	18	8	9	21

#### 5.3.4.1 2008 Avian Guild Density and Composition

Avian data were analyzed by guild using average guild density (*i.e.*, count) and average guild percent composition per sampling station. In terms of guild density, the guild community did not differ among the areas (ANOSIM, Global R= -0.017, p=0.729, Bonferroni adjusted alpha =0.0083) or between the treatment and the control marshes (ANOSIM, Global R = -0.012, p=0.583). There was a significant difference between the seasons (winter versus summer; ANOSIM, Global R =0.33, p=0.0002), with ~60% of the difference accounted for by higher Passerine guild density during the winter (SIMPER analysis). This result was likely due to an outlier, when a large flock (n=115) of red-winged blackbirds (*Agelaius phoeniceus*) were observed at one station during the winter



sampling. In terms of guild percent composition, the guild community did not differ among the areas (ANOSIM, Global R = -0.006, p=0.535, Bonferroni adjusted alpha =0.0083) or between the treatment and the control marshes (ANOSIM, Global R = -0.015, p=0.609). There was a significant difference between the seasons (winter versus summer; ANOSIM, Global R = 0.155, p=0.032), with ~46% of the difference accounted for by higher Passerine guild abundance during summer. See Table 5-26. SIMPER analyses of avian guild percent composition indicating the contribution of each guild to observed dissimilarity for significant comparisons (winter versus summer). Only guilds contributing approximately 90% of the cumulative dissimilarity are shown.

**Table 5-26. Guild Composition**

Guild	Percent Composition		Cumulative Contribution to Dissimilarity
	Winter	Summer	
Passerine	52.98	61.64	46.03
Water birds	15.93	6.78	63.20
Wading birds	6.72	12.24	78.00
Shorebirds	0.00	12.62	89.04

When season and treatment were combined, no significant difference among different combinations was observed (ANOSIM, Global R= 0.076, p= 0.072, Bonferroni adjusted alpha =0.0083) suggesting that the treatment did not have an effect on the seasonal differences in guild percent composition.

Characteristic marsh birds observed also did not change greatly during 2008 (Table 5-27). Changes in the field observers over the years could account for some of the variation observed – such as a lack of lesser yellowlegs in some years (2008), but the sighting of greater yellowlegs

during 2008 instead. Common yellowthroat is the only characteristic marsh species that has had a continued absence from the survey for several years in all Areas. Since this species is fairly easily identified in the field using binoculars, and by its song, its continued absence from the survey since 2005 may be of significant note.

**Table 5-27 Characteristic Marsh Birds observed across Wertheim National Wildlife Refuge**

Year	Area	COYE	GBHE	GREG	KILL	LESA	LEYE	MAWR	RWBL	SAND	SESP	SNEG	SSTS	WILL
2004	1	X		X	X			X	X		X		X	X
	2	X						X	X		X		X	X
	3	X						X	X		X		X	X
	4			X				X	X		X		X	X
2005	1	X	X	X	X	X	X	X	X		X	X	X	X
	2	X		X		X	X	X	X		X		X	X
	3	X				X	X	X	X		X		X	X
	4					X		X	X		X		X	X
2006	1			X	X	X		X	X			X	X	X
	2			X	X	X		X	X			X	X	X
	3			X				X	X				X	X
	4							X	X				X	X
2007	1		X	X		X	X	X	X		X	X	X	X
	2		X	X	X	X	X	X	X	X	X	X	X	X
	3			X		X	X	X	X	X		X	X	X
	4					X		X	X		X		X	X
2008	1			X		X		X	X		X	X	X	X
	2		X	X		X		X	X		X	X	X	X
	3		X			X		X	X		X	X	X	X
	4			X		X		X	X		X	X	X	X

COYE: common yellowthroat; GBHE: great blue heron; GREG: great egret; KILL: killdeer; LESA: least sandpiper; LEYE: lesser yellowlegs; MAWR: marsh wren; RWBL: red-winged blackbird; SAND: sanderling; SESP: seaside sparrow; SNEG: snowy egret; SSTS: salt marsh sharp-tailed sparrow; WILL: willet

#### 5.3.4.2 Rare, Threatened, and Endangered Bird Species

Several species of special concern were observed during the monitoring program:

- Short-eared owl (*Asio flammeus*) – In 2008, there was one observation of the short-eared owl in Area 3. During the winter 2005 surveys, a total of three short-eared owl observations were recorded during the surveys (two in Area 2 and one in Area 3).
- Bald eagle (*Haliaeetus leucocephalus*) – An immature bald eagle was recorded during the 2008 winter bird survey flying over Area 1. There were multiple observations of an immature bald eagle over the Project Area during both the winter of 2005 and 2006, while work was being undertaken on the marsh.
- Northern harrier (*Circus cyaneus*) – This species was found in all four areas during the 2005 winter surveys and in Areas 1 and 2 during the 2007 winter surveys. In 2008, the northern harrier was observed in Areas 2, 3 and 4 during the winter survey and during the September summer survey at Area 3.
- Osprey (*Pandion haliaetus*) – There were two established osprey nests located within proximity to the project area (one in the southern section of Area 1 and one in the impoundment located near Areas 2 and 3). Both of these nests were occupied during breeding and fledgling periods and therefore no impacts appeared to be associated with the project. Also, as part of the project in early spring of 2006, an additional nesting pole was installed on the upland side of the northern section of Area 1. During the summer of 2006 a partial nest was observed at this location. Osprey were regularly observed flying over all Areas during the summer surveys.
- Seaside sparrow (*Ammodramus maritimus*) – During the 2004 and 2005 summer surveys, seaside sparrow were observed utilizing all four project areas. However, during the 2006 summer surveys, no seaside sparrows were observed in any of the four project areas. This

discrepancy in observations is believed to be a consequence of changing observers, as the constant presence of the seaside sparrow in all four areas during the surveys of the prior two years makes it less likely that no seaside sparrows utilized the areas in 2006. A greater effort was made to distinguish seaside sparrows in 2007, and they were observed in Area 1, Area 2, and Area 4 in 2007. During 2008, seaside sparrows were observed in all areas.

- Black rail (*Laterallus jamaicensis*) – Black rail were observed on the marsh in Area 3 several times in 2008, by multiple observers. None of these observations were made during the bird surveys.

## 6.0 Discussion

Monitoring results are now available for 4 growing seasons after the alterations in Area 1 (modified in 2005) and three growing seasons after the alterations in Area 2 (modified in 2006). The marsh community has now had time to adjust to the new conditions, and further changes are likely to happen more slowly than the immediate post construction period. It therefore seems to be an appropriate time to provisionally evaluate the extent to which the project is meeting its goals.

Larval mosquito data are readily available for analysis due to a fully automated data acquisition and management process utilized by Suffolk County Vector Control. Accordingly, it was possible to conduct a comprehensive review of the data to reach the conclusions discussed in this section ranging from sampling methods to the number of larvicide application. The comparison of the two sampling methods used to assess mosquito population level/production in this project indicated that transect sampling generated significantly more "no data" points and was significantly less efficient in locating mosquito larvae than targeted sampling. However, the pre and post treatment results obtained by either method showed similar trends. The proportion of "wet" samples containing standing water did not change drastically in either impacted or control areas following the intervention as measured by both transect and targeted methods. The proportion of "wet" samples that were positive, *i.e.*, contained mosquito larvae, significantly



decreased in the treatment areas while remaining similar in the control areas post intervention as indicated by both transect and targeted methods. The number of larvae per dip while very variable, exhibited the same trend, with significantly lower numbers observed in the treatment areas post intervention, as indicated by both transect and targeted methods. The reduced frequency of finding mosquito larvae in the treatment areas led to a statistically significant ~74% reduction in the number of larvicide applications in the treatment versus the control areas post intervention. The continued larvicide applications may have potentially confounded the intervention (*i.e.*, before and after) effect (James-Pirri et al., 2008). However, the number of larvicide applications was significantly higher in the control areas than that in the post-project treatment areas. Therefore, the confounding effect would have acted to reduce the difference between the control and the treatment areas by allowing fewer larvae to survive from one sampling date to the next in the control areas than in the treatment sites. Since the opposite difference (*i.e.*, reduced frequency and number per dip in the treatment areas) was clearly demonstrated, the magnitude of the intervention effect may have been even greater than that observed in this data set.

The geostatistical analysis of the remaining larval habitat in the treatment areas post intervention indicated a significant geographic shift. Whereas virtually no mosquito breeding was observed in the proximity of mosquito ditches pre treatment, filled-in ditches constituted the bulk of the new larval habitat post-treatment. Filling-in mosquito ditches is not an OMWM technique and represents a marsh restoration component of the project. Finding new larval habitat suggests that some of the restored marsh surface may harbor suitable environments for mosquito production. Field personnel noted that the surface of some of the newly filled-in ditches was slightly concave and held standing water. However, many of these areas were re-vegetating vigorously in 2007-08 and appeared flush with the marsh level resulting in less larval habitat and fewer larvae. Thus, these areas will continue to be monitored and, if some of the new mosquito larval habitat proves to be persistent, minor modifications to increase connectivity and/or drainage may be considered. The results of this geostatistical analysis confirm the value of targeted sampling in understanding exactly how the overall marsh alterations impacted larval habitats, something that would not have been possible with transect sampling alone.

To summarize, it is clear the project has dramatically reduced the spatial extent and frequency of finding mosquito larvae in the managed areas. Geospatial analysis indicates that the larvae have been virtually eliminated from those parts of the marsh where they were found pre-project, while some new larval habitats have been inadvertently created as a result of filling the old grid ditches. However, most of the ditch filling did not result in the creation of new larval habitats, and the ones that were created are small and may even be disappearing as the area continues to revegetate, especially in Area 2. These remaining larval habitats could be easily eliminated through some minor alterations to the project, should this be deemed desirable. Even though a few larval habitats remain, the need for larvicide applications has been drastically reduced, and could be eliminated entirely if these remaining habitats are managed. The BACI design ensures that these observations are not the result of seasonal differences, and they are statistically robust. This analysis has, in fact, been accepted in a peer-reviewed scientific journal for publication (Rochlin, Iwanejko, Dempsey, & Ninivaggi, 2009).

Unlike mosquito larval data, other types of data on ecological functions, vegetation, and fish/wildlife have not been fully digitized for the period of 2003-2007. Therefore, only 2008 quantitative data analyses are presented in this report. Ecological function as measured by water table height, soil salinity and measures of plant community biomass, production and species composition were all either similar in the managed versus reference area or were improved by the marsh alterations. The managed areas, especially Area 1, were revegetated with a diverse array of native, high marsh plants. Live biomass was higher in the managed areas versus the reference sites. The higher below-ground biomass in the managed areas is especially worth noting, since this is the portion of the plants that survives from year to year and helps stabilize the marsh surface. The extent of *Phragmites* has been reduced in the managed areas, also in keeping with project goals. This aspect of the project will become more difficult to evaluate in the future, since USFWS has initiated a program of *Phragmites* control on the Refuge utilizing herbicides and physical removal of the dead stalks. The program includes the reference sites and parts of the managed areas.

In terms of fish and wildlife habitat and diversity, the managed areas clearly support populations and diversity equal or superior to the reference areas. The main statistical difference between the

managed and reference areas in 2008 was an increase in nekton species richness in the managed areas.

In summary, the project appears to be meeting its goals up to this point, the immediate post-construction phase. Further monitoring will take place to evaluate whether these changes are sustained over time. The lessons learned in the course of this project should be considered in future projects of this kind in Suffolk County.

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## **REPORT ADDENDUM: PHRAGMITES CONTROL PROGRAM**

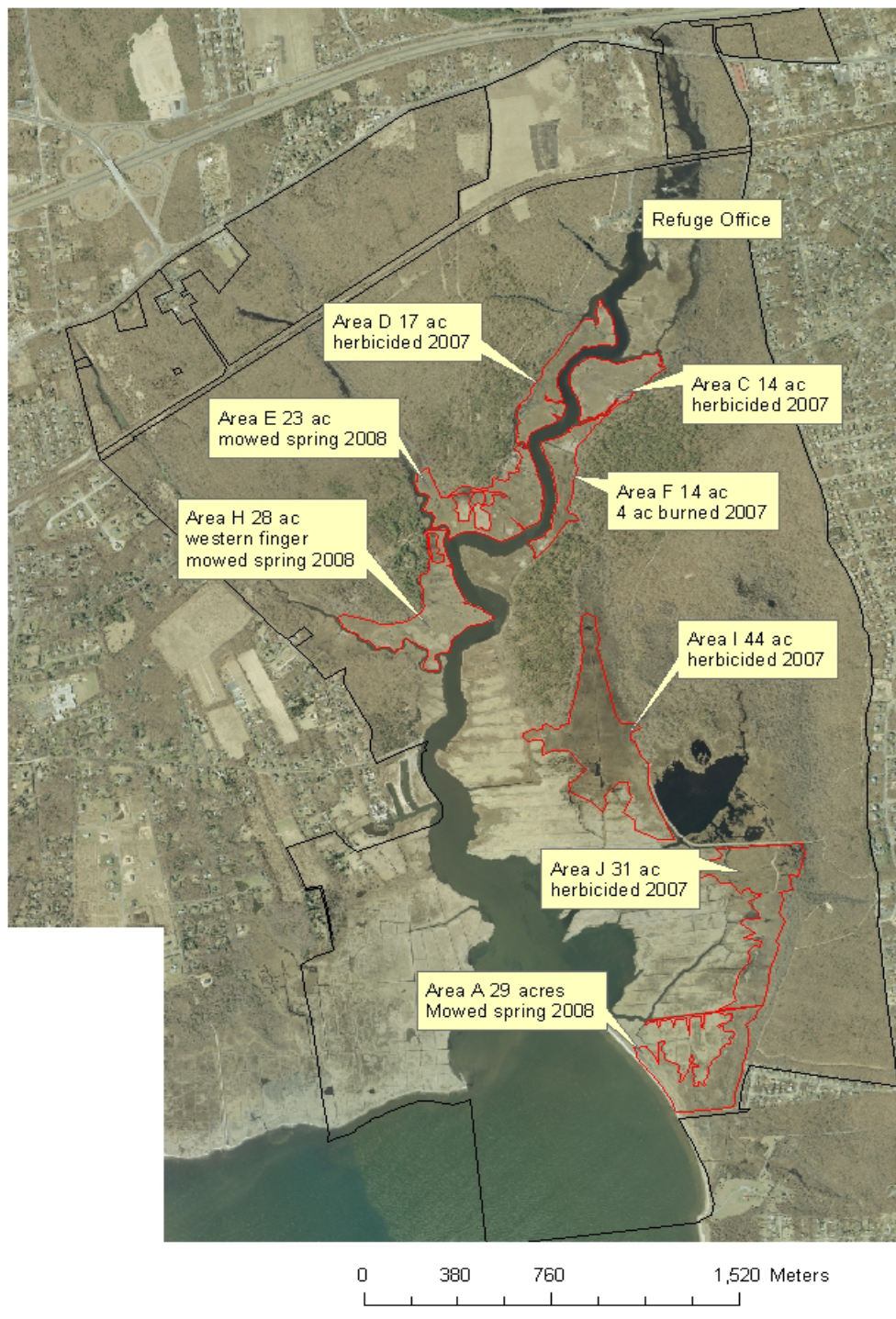
Since the 1970s, *Phragmites australis* (Phragmites) or the common reed has encroached upon the wetlands and tidal reaches of the Carmans River. USFWS staff have actively sought to actively control Phragmites as it displaces native vegetation and provides poor habitat for both fish and wildlife species due to its dense monotypic stands. Phragmites can also contribute to wildfires and eradication of this species from portions of the Refuge will reduce the risk of wildfire to neighboring residential areas.

In 2005, USFWS staff re-established an active Phragmites control program within the Refuge, building on previous control projects conducted in 1992 and 1999. Due to low salinity and small tidal amplitude of the Carmans River wetlands, water management alone was deemed not effective enough to control the rapidly expanding Phragmites. Use of herbicide applications (Aquamaster® - glyphosate) followed by removal of dead stalks via mowing and prescribed fire were initiated, upon issuance of a permit by the DEC.

Approximately two-hundred and fifty acres of Phragmites dominated marsh have been treated with an application of the herbicide Aquamaster® since 2005. The figure below shows those areas of WNWR treated with various Phragmites control activities as of June 19, 2008. Large expanses of Phragmites stands were treated with herbicide applications using a helicopter in 2007 and 2008. Smaller or mixed stands were selectively treated by hand using low ground pressure, tracked equipment. Typically, two herbicide applications were applied, followed by spot hand applications to eradicate this species.

Standing thatch removal was accomplished by the USFWS's Regional Fire Program that included mowing approximately ninety acres in 2008. Additional thatch removal was accomplished by the Long Island Interagency Wildfire Crew (consisting of firefighters from USFWS, the New York State Forest Rangers, The Nature Conservancy, U.S. Department of Agriculture, Suffolk County, and other volunteers) on approximately 30 acres using prescribed burning.

## Wertheim NWR Areas Treated as of June 19, 2008



The combined efforts of the Phragmites control program appear to have had a positive effect on the Wertheim site. While no seeding has taken place, USFWS staff reported that more than two dozen native plant species have become re-established through propagules present in the seed bank. The USFWS staff will continue to treat approximately ten to forty acres of common reed-dominated marsh each year using spot herbicide applications and mowing until a maintenance level of less than 5% coverage of Phragmites remains in tidal marshes within the refuge.

USFWS staff report that bird species such as black duck, great egret, glossy ibis, snowy egret, greater yellowlegs, northern harrier and short-eared owl have been found foraging on these reclaimed sites. Native vegetative coverage and species richness should continue to increase for several growing seasons through continued active management of any Phragmites that may remain.

#### **IMPACTS TO THE DEMONSTRATION PROJECT FROM THE PHRAGMITES CONTROL PROGRAM**

The Phragmites control program has greatly impacted Area 4 of the Wertheim NWR Water Management Demonstration Project. Other areas of the Project were impacted minimally or not at all by this effort. No Phragmites control efforts were undertaken in Area 1 and Area 2, and only a small strip of Area 3 along the impoundment access road was treated and mowed. See the figure above. Future planned Phragmites control efforts may have a larger impact on Area 3. While preserving the control areas would be beneficial from a scientific study point of view for this demonstration project, the benefits to wildlife already appear to be great. Sampling will continue in all areas, and changes to the marsh composition, avian community and other parameters due to the Phragmites control program should continue to be readily apparent in years to come.



## **APPENDICES**

Appendix A	Water Table Height and Pore Water Salinity, 2008
Appendix B	Vegetation Quadrat, 2008
Appendix C	Vegetation Biomass, 2008
Appendix D	Vegetation Photographs, 2008
Appendix E	Mosquito Larvae, 2008
Appendix F	Nekton Sampling, 2008
Appendix G	Bird Survey, 2008



## **Appendix A**

### Water Table Height and Pore Water Salinity 2008



Wertheim NWR Water Management Demonstration Project Data Report  
 Water Table Height and Pore Water Salinity  
 2008

Date	Area	Station	Water Table Depth (cm)	Soil Salinity (ppt)	Depth of Soil Salinity (cm)
Area 1					
05/22/08	A1	1-1-00	-2.9	11	15
05/22/08	A1	1-1-40	3.1	14	45
05/22/08	A1	1-1-80	-0.4	14	15
05/22/08	A1	1-1-120	-1.8	17	15
05/22/08	A1	1-2-00	4.4	18	15
05/22/08	A1	1-2-40	0.2	20	15
05/22/08	A1	1-2-80	-0.9	16	15
05/22/08	A1	1-2-120	-----	23	15
05/22/08	A1	1-3-00	0.9	11	15
05/22/08	A1	1-3-40	0.7	15	15
05/22/08	A1	1-3-80	-5.9	13	15
05/22/08	A1	1-3-120	0.5	15	15
05/22/08	A1	1-3-160	-1.4	14	15
05/22/08	A1	1-3-200	-0.1	19	15
05/22/08	A1	1-4-00	-2.4	14	15
05/22/08	A1	1-4-40	-2.6	14	15
05/22/08	A1	1-4-80	-5.7	12	15
05/22/08	A1	1-4-120	-2.1	13	15
05/22/08	A1	1-4-160	-0.3	16	15
05/22/08	A1	1-4-200	-3.4	15	15
05/22/08	A1	1-4-240	-2.3	15	15
05/22/08	A1	1-5-00	-7.7	16	15
05/22/08	A1	1-5-40	-0.2	20	15
05/22/08	A1	1-5-80	2.1	15	15
05/29/08	A1	1-1-00	-14.7	11	15
05/29/08	A1	1-1-40	7.7	14	15
05/29/08	A1	1-1-80	-6.0	14	15
05/29/08	A1	1-1-120	-5.3	18	15
05/29/08	A1	1-2-00	-3.8	13	15
05/29/08	A1	1-2-40	-8.7	20	15
05/29/08	A1	1-2-80	-5.9	17	15
05/29/08	A1	1-2-120	2.3	22	15
05/29/08	A1	1-3-00	-7.2	14	15
05/29/08	A1	1-3-40	-4.1	16	15
05/29/08	A1	1-3-80	-17.6	15	15
05/29/08	A1	1-3-120	-7.8	15	15
05/29/08	A1	1-3-160	-7.6	17	15
05/29/08	A1	1-3-200	-5.2	20	15
05/29/08	A1	1-4-00	-9.9	12	15
05/29/08	A1	1-4-40	-16.4	14	15
05/29/08	A1	1-4-80	-11.4	17	15
05/29/08	A1	1-4-120	-8.7	15	15
05/29/08	A1	1-4-160	-9.4	18	15
05/29/08	A1	1-4-200	-11.2	15	15
05/29/08	A1	1-4-240	-11.8	16	15
05/29/08	A1	1-5-00	-18.8	16	15
05/29/08	A1	1-5-40	1.3	21	15
05/29/08	A1	1-5-80	-8.2	18	15
06/12/08	A1	1-1-00	-18.4	10	30
06/12/08	A1	1-1-40	-11.0	15	45
06/12/08	A1	1-1-80	-15.9	13	45

**Wertheim NWR Water Management Demonstration Project Data Report**  
**Water Table Height and Pore Water Salinity**  
**2008**

Date	Area	Station	Water Table Depth (cm)	Soil Salinity (ppt)	Depth of Soil Salinity (cm)
06/12/08	A1	1-1-120	-20.4	18	15
06/12/08	A1	1-2-00	-14.2	16	15
06/12/08	A1	1-2-40	-18.2	18	15
06/12/08	A1	1-2-80	-4.4	16	15
06/12/08	A1	1-2-120	-13.3	20	15
06/12/08	A1	1-3-00	-11.0	10	15
06/12/08	A1	1-3-40	-13.9	6	15
06/12/08	A1	1-3-80	-19.2	11	15
06/12/08	A1	1-3-120	-6.6	15	15
06/12/08	A1	1-3-160	-16.5	10	15
06/12/08	A1	1-3-200	-22.7	17	15
06/12/08	A1	1-4-00	-15.9	9	15
06/12/08	A1	1-4-40	-20.6	9	15
06/12/08	A1	1-4-80	-19.2	16	15
06/12/08	A1	1-4-120	-17.4	20	45
06/12/08	A1	1-4-160	-15.9	16	15
06/12/08	A1	1-4-200	-16.3	10	15
06/12/08	A1	1-4-240	-16.7	12	15
06/12/08	A1	1-5-00	-19.8	11	15
06/12/08	A1	1-5-40	-0.3	19	15
06/12/08	A1	1-5-80	-14.8	11	15
06/25/08	A1	1-1-00	-11.6	10	15
06/25/08	A1	1-1-40	9.6	11	15
06/25/08	A1	1-1-80	-8.4	13	15
06/25/08	A1	1-1-120	-10.5	17	15
06/25/08	A1	1-2-00	-2.7	14	15
06/25/08	A1	1-2-40	-7.3	18	15
06/25/08	A1	1-2-80	-7.6	17	15
06/25/08	A1	1-2-120	-4.2	20	15
06/25/08	A1	1-3-00	-6.0	10	15
06/25/08	A1	1-3-40	-5.3	14	15
06/25/08	A1	1-3-80	-16.1	17	15
06/25/08	A1	1-3-120	-8.0	16	15
06/25/08	A1	1-3-160	-10.4	15	15
06/25/08	A1	1-3-200	-13.3	20	15
06/25/08	A1	1-4-00	-19.6	9	15
06/25/08	A1	1-4-40	-14.0	11	15
06/25/08	A1	1-4-80	-11.7	16	15
06/25/08	A1	1-4-120	-7.3	17	15
06/25/08	A1	1-4-160	-7.6	14	15
06/25/08	A1	1-4-200	-11.2	11	15
06/25/08	A1	1-4-240	-10.4	11	15
06/25/08	A1	1-5-00	-16.8	12	15
06/25/08	A1	1-5-40	3.0	19	15
06/25/08	A1	1-5-80	-7.8	15	15
07/09/08	A1	1-1-00	4.0	11	45
07/09/08	A1	1-1-40	-5.8	8	15
07/09/08	A1	1-1-80	-8.7	12	15
07/09/08	A1	1-1-120	-18.6	15	15
07/09/08	A1	1-2-00	0.2	11	15
07/09/08	A1	1-2-40	-10.6	16	15
07/09/08	A1	1-2-80	-8.0	15	15



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Water Table Height and Pore Water Salinity  
2008**

Date	Area	Station	Water Table Depth (cm)	Soil Salinity (ppt)	Depth of Soil Salinity (cm)
07/09/08	A1	1-2-120	-6.9	18	30
07/09/08	A1	1-3-00	-1.2	10	15
07/09/08	A1	1-3-40	-8.3	12	15
07/09/08	A1	1-3-80	-1.6	18	15
07/09/08	A1	1-3-120	-7.6	15	15
07/09/08	A1	1-3-160	-13.4	14	15
07/09/08	A1	1-3-200	-14.4	18	30
07/09/08	A1	1-4-00	-5.5	9	15
07/09/08	A1	1-4-40	-9.3	8	15
07/09/08	A1	1-4-80	-5.5	14	15
07/09/08	A1	1-4-120	-3.3	15	15
07/09/08	A1	1-4-160	-2.7	13	15
07/09/08	A1	1-4-200	-7.8	9	15
07/09/08	A1	1-4-240	-5.9	11	15
07/09/08	A1	1-5-00	-11.3	8	30
07/09/08	A1	1-5-40	3.5	16	15
07/09/08	A1	1-5-80	-2.1	10	15
07/21/08	A1	1-1-00	-2.4	8	15
07/21/08	A1	1-1-40	-13.0	11	45
07/21/08	A1	1-1-80	-2.1	11	15
07/21/08	A1	1-1-120	-0.5	16	15
07/21/08	A1	1-2-00	3.8	13	15
07/21/08	A1	1-2-40	3.8	17	15
07/21/08	A1	1-2-80	-0.3	18	15
07/21/08	A1	1-2-120	9.8	18	30
07/21/08	A1	1-3-00	-0.2	11	15
07/21/08	A1	1-3-40	0.1	18	15
07/21/08	A1	1-3-80	-3.1	12	15
07/21/08	A1	1-3-120	1.0	11	15
07/21/08	A1	1-3-160	-2.2	15	15
07/21/08	A1	1-3-200	-0.8	18	15
07/21/08	A1	1-4-00	0.1	9	15
07/21/08	A1	1-4-40	-5.4	9	15
07/21/08	A1	1-4-80	-1.9	13	15
07/21/08	A1	1-4-120	-1.7	14	15
07/21/08	A1	1-4-160	0.8	14	15
07/21/08	A1	1-4-200	-1.9	8	15
07/21/08	A1	1-4-240	-0.5	12	15
07/21/08	A1	1-5-00	-6.6	9	15
07/21/08	A1	1-5-40	5.3	15	30
07/21/08	A1	1-5-80	1.8	13	15
08/07/08	A1	1-1-00	-5.4	9	15
08/07/08	A1	1-1-40	7.1	11	15
08/07/08	A1	1-1-80	-4.0	14	15
08/07/08	A1	1-1-120	-1.5	13	15
08/07/08	A1	1-2-00	2.0	12	15
08/07/08	A1	1-2-40	1.2	16	15
08/07/08	A1	1-2-80	-2.1	15	15
08/07/08	A1	1-2-120	-1.6	17	15
08/07/08	A1	1-3-00	-1.8	10	15
08/07/08	A1	1-3-40	-0.4	11	15
08/07/08	A1	1-3-80	7.9	13	15

**Wertheim NWR Water Management Demonstration Project Data Report**  
**Water Table Height and Pore Water Salinity**  
**2008**

Date	Area	Station	Water Table Depth (cm)	Soil Salinity (ppt)	Depth of Soil Salinity (cm)
08/07/08	A1	1-3-120	-2.8	11	15
08/07/08	A1	1-3-160	-4.4	14	15
08/07/08	A1	1-3-200	-0.8	21	15
08/07/08	A1	1-4-00	-5.2	6	15
08/07/08	A1	1-4-40	-10.3	7	15
08/07/08	A1	1-4-80	-6.4	11	15
08/07/08	A1	1-4-120	-2.7	16	15
08/07/08	A1	1-4-160	-1.4	12	15
08/07/08	A1	1-4-200	-7.7	8	15
08/07/08	A1	1-4-240	-5.3	9	15
08/07/08	A1	1-5-00	-13.8	9	15
08/07/08	A1	1-5-40	4.5	16	30
08/07/08	A1	1-5-80	-0.2	11	15
08/21/08	A1	1-1-00	-16.8	9	45
08/21/08	A1	1-1-40	8.3	11	15
08/21/08	A1	1-1-80	-11.2	14	15
08/21/08	A1	1-1-120	-10.3	14	15
08/21/08	A1	1-2-00	-7.9	13	15
08/21/08	A1	1-2-40	-8.4	16	15
08/21/08	A1	1-2-80	-7.2	16	15
08/21/08	A1	1-2-120	-1.4	19	15
08/21/08	A1	1-3-00	-8.4	12	15
08/21/08	A1	1-3-40	-6.7	12	15
08/21/08	A1	1-3-80	-15.5	15	15
08/21/08	A1	1-3-120	-6.4	17	15
08/21/08	A1	1-3-160	-8.9	14	15
08/21/08	A1	1-3-200	-10.0	21	15
08/21/08	A1	1-4-00	-13.8	8	15
08/21/08	A1	1-4-40	-15.3	10	30
08/21/08	A1	1-4-80	-13.1	19	30
08/21/08	A1	1-4-120	-7.4	19	15
08/21/08	A1	1-4-160	-9.4	18	15
08/21/08	A1	1-4-200	-12.0	11	15
08/21/08	A1	1-4-240	-12.4	12	15
08/21/08	A1	1-5-00	-15.7	10	15
08/21/08	A1	1-5-40	4.6	17	30
08/21/08	A1	1-5-80	-6.2	12	15
09/05/08	A1	1-1-00	-7.1	9	30
09/05/08	A1	1-1-40	7.2	12	45
09/05/08	A1	1-1-80	-4.9	14	15
09/05/08	A1	1-1-120	-3.0	17	15
09/05/08	A1	1-2-00	0.4	16	15
09/05/08	A1	1-2-40	-1.8	17	30
09/05/08	A1	1-2-80	-2.8	18	15
09/05/08	A1	1-2-120	0.5	19	30
09/05/08	A1	1-3-00	-3.6	13	15
09/05/08	A1	1-3-40	-2.2	12	15
09/05/08	A1	1-3-80	-10.8	16	15
09/05/08	A1	1-3-120	-3.5	19	15
09/05/08	A1	1-3-160	-3.6	14	15
09/05/08	A1	1-3-200	-1.3	19	15
09/05/08	A1	1-4-00	-6.0	9	15

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**Water Table Height and Pore Water Salinity**  
**2008**

Date	Area	Station	Water Table Depth (cm)	Soil Salinity (ppt)	Depth of Soil Salinity (cm)
09/05/08	A1	1-4-40	-2.6	11	15
09/05/08	A1	1-4-80	-7.1	14	15
09/05/08	A1	1-4-120	-2.7	19	15
09/05/08	A1	1-4-160	-3.0	14	15
09/05/08	A1	1-4-200	-8.8	13	15
09/05/08	A1	1-4-240	-6.0	13	15
09/05/08	A1	1-5-00	-14.1	13	15
09/05/08	A1	1-5-40	8.1	17	15
09/05/08	A1	1-5-80	-1.5	14	15
09/18/08	A1	1-1-00	-7.3	9	15
09/18/08	A1	1-1-40	6.8	13	45
09/18/08	A1	1-1-80	-8.5	16	15
09/18/08	A1	1-1-120	-8.0	16	15
09/18/08	A1	1-2-00	-2.0	16	15
09/18/08	A1	1-2-40	-7.0	18	15
09/18/08	A1	1-2-80	-5.9	17	15
09/18/08	A1	1-2-120	1.1	19	15
09/18/08	A1	1-3-00	-6.0	11	15
09/18/08	A1	1-3-40	-5.9	12	15
09/18/08	A1	1-3-80	-11.4	13	15
09/18/08	A1	1-3-120	-5.2	18	15
09/18/08	A1	1-3-160	-9.1	15	15
09/18/08	A1	1-3-200	-5.0	21	15
09/18/08	A1	1-4-00	-11.3	8	15
09/18/08	A1	1-4-40	-15.7	10	15
09/18/08	A1	1-4-80	-8.6	13	15
09/18/08	A1	1-4-120	-4.5	19	15
09/18/08	A1	1-4-160	-5.1	13	15
09/18/08	A1	1-4-200	-9.0	10	15
09/18/08	A1	1-4-240	-7.5	12	15
09/18/08	A1	1-5-00	-14.9	11	15
09/18/08	A1	1-5-40	4.4	16	15
09/18/08	A1	1-5-80	-5.2	12	15
10/20/08	A1	1-1-00	-1.9	13	15
10/20/08	A1	1-1-40	11.0	14	15
10/20/08	A1	1-1-80	-0.8	16	15
10/20/08	A1	1-1-120	-0.3	17	15
10/20/08	A1	1-2-00	5.5	16	15
10/20/08	A1	1-2-40	2.2	18	15
10/20/08	A1	1-2-80	1.1	18	15
10/20/08	A1	1-2-120	5.6	19	15
10/20/08	A1	1-3-00	0.8	18	15
10/20/08	A1	1-3-40	1.7	15	15
10/20/08	A1	1-3-80	0.5	17	15
10/20/08	A1	1-3-120	1.4	20	15
10/20/08	A1	1-3-160	-0.7	17	15
10/20/08	A1	1-3-200	-0.6	23	15
10/20/08	A1	1-4-00	-0.7	10	15
10/20/08	A1	1-4-40	1.0	13	15
10/20/08	A1	1-4-80	0.5	15	15
10/20/08	A1	1-4-120	-1.0	17	15
10/20/08	A1	1-4-160	-0.6	17	15

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Water Table Height and Pore Water Salinity  
2008**

Date	Area	Station	Water Table Depth (cm)	Soil Salinity (ppt)	Depth of Soil Salinity (cm)
10/20/08	A1	1-4-200	-0.5	15	15
10/20/08	A1	1-4-240	0.1	16	15
10/20/08	A1	1-5-00	0.2	16	15
10/20/08	A1	1-5-40	8.5	21	15
10/20/08	A1	1-5-80	2.8	14	15

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 Water Table Height and Pore Water Salinity  
 2008

Date	Area	Station	Water Table Depth (cm)	Soil Salinity (ppt)	Depth of Soil Salinity (cm)
Area 2					
5/21/08	A2	2-1-00	0.5	12	15
5/21/08	A2	2-1-40	2.4	17	15
5/21/08	A2	2-1-80	Can't find well	21	15
5/21/08	A2	2-1-120	6.6	20	15
5/21/08	A2	2-1-160	2.9	20	15
5/21/08	A2	2-2-00	-8.6	12	15
5/21/08	A2	2-2-40	-4.3	8	15
5/21/08	A2	2-2-80	1.7	20	15
5/21/08	A2	2-2-120	-0.3	23	15
5/21/08	A2	2-2-160	5.7	21	15
5/21/08	A2	2-2-200	-13.2	18	15
5/21/08	A2	2-3-00	-0.8	16	15
5/21/08	A2	2-3-40	4.4	30	15
5/21/08	A2	2-3-80	1.7	31	15
5/21/08	A2	2-3-120	15.2	20	15
5/21/08	A2	2-3-160	6.3	25	15
5/21/08	A2	2-3-200	0.8	26	15
5/21/08	A2	2-4-00	3.5	26	15
5/21/08	A2	2-4-40	4.6	23	15
5/21/08	A2	2-4-80	-0.5	25	15
5/21/08	A2	2-4-120	1.7	21	15
5/21/08	A2	2-5-00	-0.4	27	30
5/21/08	A2	2-5-40	2.7	20	15
5/21/08	A2	2-5-80	0.7	23	15
5/30/08	A2	2-1-00	-14.4	10	15
5/30/08	A2	2-1-40	-2.3	19	15
5/30/08	A2	2-1-80	6.6	22	15
5/30/08	A2	2-1-120	-3.1	20	15
5/30/08	A2	2-1-160	-3.7	19	15
5/30/08	A2	2-2-00	-13.9	13	15
5/30/08	A2	2-2-40	-17.8	11	15
5/30/08	A2	2-2-80	-6.4	19	15
5/30/08	A2	2-2-120	-0.1	22	15
5/30/08	A2	2-2-160	-3.2	20	15
5/30/08	A2	2-2-200	-25.1	15	30
5/30/08	A2	2-3-00	-15.8	19	15
5/30/08	A2	2-3-40	-2.8	29	15
5/30/08	A2	2-3-80	2.6	30	15
5/30/08	A2	2-3-120	-2.0	20	15
5/30/08	A2	2-3-160	1.0	26	15
5/30/08	A2	2-3-200	-9.9	24	15
5/30/08	A2	2-4-00	-3.1	24	15
5/30/08	A2	2-4-40	-8.2	20	15
5/30/08	A2	2-4-80	Top of well stuck	22	15
5/30/08	A2	2-4-120	-9.9	21	15
5/30/08	A2	2-5-00	-12.7	26	30
5/30/08	A2	2-5-40	-8.5	18	15
5/30/08	A2	2-5-80	-9.7	21	15
6/13/08	A2	2-1-00	-18.3	12	15
6/13/08	A2	2-1-40	-9.0	17	15
6/13/08	A2	2-1-80	Top of well stuck	21	15

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2008

Date	Area	Station	Water Table Depth (cm)	Soil Salinity (ppt)	Depth of Soil Salinity (cm)
6/13/08	A2	2-1-120	-5.0	17	15
6/13/08	A2	2-1-160	-11.6	18	15
6/13/08	A2	2-2-00	-16.7	10	45
6/13/08	A2	2-2-40	-18.5	8	15
6/13/08	A2	2-2-80	-12.9	20	15
6/13/08	A2	2-2-120	-7.9	20	15
6/13/08	A2	2-2-160	-10.4	20	15
6/13/08	A2	2-2-200	-27.7	12	30
6/13/08	A2	2-3-00	-18.8	16	15
6/13/08	A2	2-3-40	-7.6	27	15
6/13/08	A2	2-3-80	-16.2	31	15
6/13/08	A2	2-3-120	1.7	20	15
6/13/08	A2	2-3-160	-9.5	26	15
6/13/08	A2	2-3-200	-17.1	26	15
6/13/08	A2	2-4-00	-11.1	22	15
6/13/08	A2	2-4-40	-9.7	20	15
6/13/08	A2	2-4-80	Top of well stuck	21	15
6/13/08	A2	2-4-120	Top of well stuck	19	45
6/13/08	A2	2-5-00	-22.4	23	15
6/13/08	A2	2-5-40	-18.1	20	15
6/13/08	A2	2-5-80	-17.1	20	15
6/26/08	A2	2-1-00	-8.2	9	15
6/26/08	A2	2-1-40	-1.0	14	15
6/26/08	A2	2-1-80	-4.4	19	15
6/26/08	A2	2-1-120	7.0	16	15
6/26/08	A2	2-1-160	-5.9	17	15
6/26/08	A2	2-2-00	-10.9	8	15
6/26/08	A2	2-2-40	-10.9	7	15
6/26/08	A2	2-2-80	-3.7	20	15
6/26/08	A2	2-2-120	-0.7	19	15
6/26/08	A2	2-2-160	-5.8	17	15
6/26/08	A2	2-2-200	-12.4	9	15
6/26/08	A2	2-3-00	-9.7	15	15
6/26/08	A2	2-3-40	-1.0	26	15
6/26/08	A2	2-3-80	-4.8	31	15
6/26/08	A2	2-3-120	0.4	17	15
6/26/08	A2	2-3-160	-2.0	14	15
6/26/08	A2	2-3-200	-11.8	22	15
6/26/08	A2	2-4-00	-4.6	21	15
6/26/08	A2	2-4-40	-9.2	18	15
6/26/08	A2	2-4-80	-3.6	19	15
6/26/08	A2	2-4-120	-14.4	20	15
6/26/08	A2	2-5-00	-13.4	21	15
6/26/08	A2	2-5-40	-9.8	19	15
6/26/08	A2	2-5-80	-10.8	18	15
7/10/08	A2	2-1-00	-8.0	6	15
7/10/08	A2	2-1-40	0.8	10	15
7/10/08	A2	2-1-80	-3.0	19	15
7/10/08	A2	2-1-120	-3.2	15	30
7/10/08	A2	2-1-160	-3.9	15	15
7/10/08	A2	2-2-00	-12.2	8	15
7/10/08	A2	2-2-40	-15.9	9	15



**Wertheim NWR Water Management Demonstration Project Data Report**  
**Water Table Height and Pore Water Salinity**  
**2008**

Date	Area	Station	Water Table Depth (cm)	Soil Salinity (ppt)	Depth of Soil Salinity (cm)
7/10/08	A2	2-2-80	-2.5	16	15
7/10/08	A2	2-2-120	-4.1	20	15
7/10/08	A2	2-2-160	-5.7	19	30
7/10/08	A2	2-2-200	-15.4	11	30
7/10/08	A2	2-3-00	-10.8	15	45
7/10/08	A2	2-3-40	0.3	27	30
7/10/08	A2	2-3-80	-1.4	29	15
7/10/08	A2	2-3-120	3.9	17	15
7/10/08	A2	2-3-160	-5.5	25	15
7/10/08	A2	2-3-200	-17.2	24	15
7/10/08	A2	2-4-00	-5.6	23	15
7/10/08	A2	2-4-40	-8.7	19	15
7/10/08	A2	2-4-80	-7.8	21	45
7/10/08	A2	2-4-120	-18.0	20	15
7/10/08	A2	2-5-00	-16.4	22	30
7/10/08	A2	2-5-40	-22.6	20	15
7/10/08	A2	2-5-80	-14.6	18	15
7/23/08	A2	2-1-00	-5.5	11	15
7/23/08	A2	2-1-40	1.0	13	15
7/23/08	A2	2-1-80	-0.5	15	15
7/23/08	A2	2-1-120	-2.5	8	15
7/23/08	A2	2-1-160	0.5	16	15
7/23/08	A2	2-2-00	-10.5	9	15
7/23/08	A2	2-2-40	-10.5	10	15
7/23/08	A2	2-2-80	1.0	20	15
7/23/08	A2	2-2-120	0.0	18	15
7/23/08	A2	2-2-160	1.0	20	15
7/23/08	A2	2-2-200	-17.5	6	15
7/23/08	A2	2-3-00	-7.0	14	15
7/23/08	A2	2-3-40	3.0	26	15
7/23/08	A2	2-3-80	-0.5	27	15
7/23/08	A2	2-3-120	3.5	15	15
7/23/08	A2	2-3-160	5.0	18	15
7/23/08	A2	2-3-200	0.0	26	15
7/23/08	A2	2-4-00	1.0	20	15
7/23/08	A2	2-4-40	2.5	14	15
7/23/08	A2	2-4-80	4.0	16	15
7/23/08	A2	2-4-120	0.0	16	15
7/23/08	A2	2-5-00	-6.5	26	15
7/23/08	A2	2-5-40	2.5	22	15
7/23/08	A2	2-5-80	1.5	17	15
8/8/08	A2	2-1-00	-3.9	8	15
8/8/08	A2	2-1-40	2.6	12	15
8/8/08	A2	2-1-80	-1.2	18	15
8/8/08	A2	2-1-120	-1.7	12	15
8/8/08	A2	2-1-160	0.0	14	15
8/8/08	A2	2-2-00	-11.4	8	15
8/8/08	A2	2-2-40	-12.3	9	30
8/8/08	A2	2-2-80	0.8	19	15
8/8/08	A2	2-2-120	5.0	19	45
8/8/08	A2	2-2-160	2.8	16	15
8/8/08	A2	2-2-200	-15.2	10	15

**Wertheim NWR Water Management Demonstration Project Data Report**  
**Water Table Height and Pore Water Salinity**  
**2008**

Date	Area	Station	Water Table Depth (cm)	Soil Salinity (ppt)	Depth of Soil Salinity (cm)
8/8/08	A2	2-3-00	-5.1	15	15
8/8/08	A2	2-3-40	2.3	26	15
8/8/08	A2	2-3-80	1.1	27	15
8/8/08	A2	2-3-120	3.6	18	15
8/8/08	A2	2-3-160	2.9	27	15
8/8/08	A2	2-3-200	-6.7	26	15
8/8/08	A2	2-4-00	1.1	21	15
8/8/08	A2	2-4-40	-1.2	17	15
8/8/08	A2	2-4-80	2.0	20	15
8/8/08	A2	2-4-120	-5.4	21	15
8/8/08	A2	2-5-00	-9.7	24	30
8/8/08	A2	2-5-40	-3.0	23	15
8/8/08	A2	2-5-80	-4.4	19	45
8/20/08	A2	2-1-00	-8.5	8	15
8/20/08	A2	2-1-40	0.7	13	15
8/20/08	A2	2-1-80	-0.1	16	15
8/20/08	A2	2-1-120	-1.6	13	15
8/20/08	A2	2-1-160	-0.1	15	15
8/20/08	A2	2-2-00	-10.5	8	15
8/20/08	A2	2-2-40	-12.9	9	15
8/20/08	A2	2-2-80	0.1	16	15
8/20/08	A2	2-2-120	-4.2	15	15
8/20/08	A2	2-2-160	2.7	16	15
8/20/08	A2	2-2-200	-19.3	10	30
8/20/08	A2	2-3-00	-8.5	14	15
8/20/08	A2	2-3-40	1.5	28	15
8/20/08	A2	2-3-80	-0.5	29	15
8/20/08	A2	2-3-120	5.8	19	15
8/20/08	A2	2-3-160	-12.0	29	15
8/20/08	A2	2-3-200	-21.8	30	45
8/20/08	A2	2-4-00	-2.2	23	15
8/20/08	A2	2-4-40	-6.5	18	15
8/20/08	A2	2-4-80	-12.5	23	15
8/20/08	A2	2-4-120	-23.0	25	15
8/20/08	A2	2-5-00	-18.7	24	45
8/20/08	A2	2-5-40	-15.9	26	30
8/20/08	A2	2-5-80	-13.8	21	15
9/4/08	A2	2-1-00	0.3	9	15
9/4/08	A2	2-1-40	3.0	13	15
9/4/08	A2	2-1-80	-0.1	17	15
9/4/08	A2	2-1-120	-1.4	19	15
9/4/08	A2	2-1-160	2.2	16	15
9/4/08	A2	2-2-00	-7.6	13	15
9/4/08	A2	2-2-40	-3.9	13	15
9/4/08	A2	2-2-80	2.3	18	15
9/4/08	A2	2-2-120	-0.8	19	15
9/4/08	A2	2-2-160	17.1	16	15
9/4/08	A2	2-2-200	-11.7	9	15
9/4/08	A2	2-3-00	-0.2	14	45
9/4/08	A2	2-3-40	2.7	26	15
9/4/08	A2	2-3-80	2.2	28	15
9/4/08	A2	2-3-120	-1.1	19	15

**Wertheim NWR Water Management Demonstration Project Data Report**  
**Water Table Height and Pore Water Salinity**  
**2008**

Date	Area	Station	Water Table Depth (cm)	Soil Salinity (ppt)	Depth of Soil Salinity (cm)
9/4/08	A2	2-3-160	3.8	30	15
9/4/08	A2	2-3-200	-2.7	27	30
9/4/08	A2	2-4-00	2.1	24	15
9/4/08	A2	2-4-40	2.5	16	15
9/4/08	A2	2-4-80	1.6	21	15
9/4/08	A2	2-4-120	-21.5	24	30
9/4/08	A2	2-5-00	-5.3	23	45
9/4/08	A2	2-5-40	-3.6	27	15
9/4/08	A2	2-5-80	0.4	26	15
9/19/08	A2	2-1-00	-9.5	12	15
9/19/08	A2	2-1-40	-0.3	15	15
9/19/08	A2	2-1-80	-2.4	19	15
9/19/08	A2	2-1-120	-2.2	17	15
9/19/08	A2	2-1-160	-1.6	16	15
9/19/08	A2	2-2-00	-11.8	11	15
9/19/08	A2	2-2-40	-4.8	10	15
9/19/08	A2	2-2-80	-4.3	19	15
9/19/08	A2	2-2-120	2.0	22	15
9/19/08	A2	2-2-160	-2.7	16	15
9/19/08	A2	2-2-200	-12.4	12	30
9/19/08	A2	2-3-00	-12.9	15	15
9/19/08	A2	2-3-40	-0.2	30	15
9/19/08	A2	2-3-80	-1.8	31	15
9/19/08	A2	2-3-120	6.6	21	15
9/19/08	A2	2-3-160	1.7	34	15
9/19/08	A2	2-3-200	-8.1	33	15
9/19/08	A2	2-4-00	-0.3	22	15
9/19/08	A2	2-4-40	-6.1	16	15
9/19/08	A2	2-4-80	-0.1	22	15
9/19/08	A2	2-4-120	-8.3	27	15
9/19/08	A2	2-5-00	-11.8	24	30
9/19/08	A2	2-5-40	-5.7	28	15
9/19/08	A2	2-5-80	-10.6	20	15
10/24/08	A2	2-1-00	0.8	21	15
10/24/08	A2	2-1-40	4.0	21	15
10/24/08	A2	2-1-80	0.9	23	15
10/24/08	A2	2-1-120	3.8	23	15
10/24/08	A2	2-1-160	2.5	24	15
10/24/08	A2	2-2-00	-7.3	17	15
10/24/08	A2	2-2-40	-1.5	19	15
10/24/08	A2	2-2-80	2.4	25	15
10/24/08	A2	2-2-120	8.0	24	15
10/24/08	A2	2-2-160	6.4	26	15
10/24/08	A2	2-2-200	-12.1	18	15
10/24/08	A2	2-3-00	-2.5	20	15
10/24/08	A2	2-3-40	----	31	15
10/24/08	A2	2-3-80	3.0	31	15
10/24/08	A2	2-3-120	-3.7	26	15
10/24/08	A2	2-3-160	5.5	32	15
10/24/08	A2	2-3-200	-0.2	34	15
10/24/08	A2	2-4-00	2.6	26	15
10/24/08	A2	2-4-40	3.5	21	15

Wertheim NWR Water Management Demonstration Project Data Report  
Water Table Height and Pore Water Salinity  
2008

Date	Area	Station	Water Table Depth (cm)	Soil Salinity (ppt)	Depth of Soil Salinity (cm)
10/24/08	A2	2-4-80	3.5	27	15
10/24/08	A2	2-4-120	0.4	27	15
10/24/08	A2	2-5-00	-4.7	29	15
10/24/08	A2	2-5-40	2.6	30	15
10/24/08	A2	2-5-80	-0.4	24	15

**Wertheim NWR Water Management Demonstration Project Data Report  
Water Table Height and Pore Water Salinity  
2008**

Date	Area	Station	Water Table Depth (cm)	Soil Salinity (ppt)	Depth of Soil Salinity (cm)
<b>Area 3</b>					
05/20/08	A3	3-1-00	1.4	8	15
05/20/08	A3	3-1-40	3.8	12	15
05/20/08	A3	3-1-80	0.4	11	15
05/20/08	A3	3-1-120	0.4	10	15
05/20/08	A3	3-1-160	2.0	12	15
05/20/08	A3	3-1-200	1.8	20	15
05/20/08	A3	3-2-00	-2.5	15	15
05/20/08	A3	3-2-40	2.0	15	15
05/20/08	A3	3-2-80	2.5	15	15
05/20/08	A3	3-2-120	2.4	10	15
05/20/08	A3	3-2-160	4.8	19	15
05/20/08	A3	3-2-200	0.5	19	15
05/20/08	A3	3-3-00	-0.3	11	15
05/20/08	A3	3-3-40	2.3	10	15
05/20/08	A3	3-3-80	0.3	6	15
05/20/08	A3	3-3-120	-4.9	20	30
05/20/08	A3	3-4-00	-1.2	17	15
05/20/08	A3	3-4-40	-2.0	10	15
05/20/08	A3	3-4-80	2.6	18	15
05/20/08	A3	3-4-120	0.6	20	15
05/30/08	A3	3-1-00	-1.7	19	15
05/30/08	A3	3-1-40	1.6	20	15
05/30/08	A3	3-1-80	-5.7	15	15
05/30/08	A3	3-1-120	-9.2	22	15
05/30/08	A3	3-1-160	-10.5	23	15
05/30/08	A3	3-1-200	-7.8	24	15
05/30/08	A3	3-2-00	-21.4	16	15
05/30/08	A3	3-2-40	-2.2	20	15
05/30/08	A3	3-2-80	-9.1	18	30
05/30/08	A3	3-2-120	-7.5	20	15
05/30/08	A3	3-2-160	-0.9	25	15
05/30/08	A3	3-2-200	-10.0	20	15
05/30/08	A3	3-3-00	-12.6	18	15
05/30/08	A3	3-3-40	-6.4	21	15
05/30/08	A3	3-3-80	-8.2	23	15
05/30/08	A3	3-3-120	-8.0	21	15
05/30/08	A3	3-4-00	-16.3	24	15
05/30/08	A3	3-4-40	-10.9	16	15
05/30/08	A3	3-4-80	-6.9	25	15
05/30/08	A3	3-4-120	-11.3	22	15
06/13/08	A3	3-1-00	-6.0	13	15
06/13/08	A3	3-1-40	-3.5	17	15
06/13/08	A3	3-1-80	-7.2	8	45
06/13/08	A3	3-1-120	-16.5	20	15
06/13/08	A3	3-1-160	-19.7	23	15
06/13/08	A3	3-1-200	-17.8	24	15
06/13/08	A3	3-2-00	-24.3	11	15
06/13/08	A3	3-2-40	-8.6	19	15
06/13/08	A3	3-2-80	-11.2	18	15
06/13/08	A3	3-2-120	-13.1	20	15
06/13/08	A3	3-2-160	-7.5	25	15

**Wertheim NWR Water Management Demonstration Project Data Report**  
**Water Table Height and Pore Water Salinity**  
**2008**

Date	Area	Station	Water Table Depth (cm)	Soil Salinity (ppt)	Depth of Soil Salinity (cm)
06/13/08	A3	3-2-200	-21.1	20	15
06/13/08	A3	3-3-00	-22.4	18	15
06/13/08	A3	3-3-40	-11.4	22	15
06/13/08	A3	3-3-80	-14.9	21	15
06/13/08	A3	3-3-120	-25.0	25	45
06/13/08	A3	3-4-00	-23.3	24	15
06/13/08	A3	3-4-40	-18.6	19	15
06/13/08	A3	3-4-80	-14.2	23	15
06/13/08	A3	3-4-120	-18.4	23	15
06/26/08	A3	3-1-00	-4.2	14	15
06/26/08	A3	3-1-40	-0.6	14	15
06/26/08	A3	3-1-80	-5.5	6	15
06/26/08	A3	3-1-120	-10.3	15	15
06/26/08	A3	3-1-160	-10.9	21	15
06/26/08	A3	3-1-200	-10.6	23	15
06/26/08	A3	3-2-00	-19.6	13	45
06/26/08	A3	3-2-40	-3.2	15	15
06/26/08	A3	3-2-80	-8.0	13	15
06/26/08	A3	3-2-120	-9.0	16	15
06/26/08	A3	3-2-160	-3.6	21	15
06/26/08	A3	3-2-200	-2.1	17	15
06/26/08	A3	3-3-00	-14.1	16	15
06/26/08	A3	3-3-40	-6.8	18	15
06/26/08	A3	3-3-80	-8.3	18	15
06/26/08	A3	3-3-120	-20.2	20	45
06/26/08	A3	3-4-00	-14.7	19	15
06/26/08	A3	3-4-40	-14.1	16	15
06/26/08	A3	3-4-80	-6.2	21	15
06/26/08	A3	3-4-120	-11.9	21	15
07/10/08	A3	3-1-00	-3.8	13	15
07/10/08	A3	3-1-40	-1.4	14	15
07/10/08	A3	3-1-80	-4.9	7	45
07/10/08	A3	3-1-120	-9.6	19	15
07/10/08	A3	3-1-160	-11.8	23	15
07/10/08	A3	3-1-200	-12.0	22	15
07/10/08	A3	3-2-00	-17.2	9	15
07/10/08	A3	3-2-40	-1.9	16	15
07/10/08	A3	3-2-80	-5.4	13	15
07/10/08	A3	3-2-120	-9.7	15	15
07/10/08	A3	3-2-160	-4.6	20	15
07/10/08	A3	3-2-200	-12.9	20	15
07/10/08	A3	3-3-00	-16.4	19	15
07/10/08	A3	3-3-40	-7.7	19	15
07/10/08	A3	3-3-80	-10.8	20	15
07/10/08	A3	3-3-120	-22.5	22	45
07/10/08	A3	3-4-00	-16.9	20	30
07/10/08	A3	3-4-40	-14.8	18	15
07/10/08	A3	3-4-80	-8.3	22	15
07/10/08	A3	3-4-120	-15.5	20	15
07/23/08	A3	3-1-00	0.5	11	15
07/23/08	A3	3-1-40	2.0	14	15
07/23/08	A3	3-1-80	-4.0	10	15



**Wertheim NWR Water Management Demonstration Project Data Report**  
**Water Table Height and Pore Water Salinity**  
**2008**

Date	Area	Station	Water Table Depth (cm)	Soil Salinity (ppt)	Depth of Soil Salinity (cm)
07/23/08	A3	3-1-120	-1.5	21	15
07/23/08	A3	3-1-160	1.5	20	15
07/23/08	A3	3-1-200	1.0	26	15
07/23/08	A3	3-2-00	4.5	11	15
07/23/08	A3	3-2-40	-4.5	11	15
07/23/08	A3	3-2-80	-13.5	10	15
07/23/08	A3	3-2-120	0.5	16	15
07/23/08	A3	3-2-160	4.0	23	15
07/23/08	A3	3-2-200	0.0	12	15
07/23/08	A3	3-3-00	-1.5	20	15
07/23/08	A3	3-3-40	1.5	20	15
07/23/08	A3	3-3-80	-1.0	10	15
07/23/08	A3	3-3-120	-8.5	19	15
07/23/08	A3	3-4-00	-2.5	16	15
07/23/08	A3	3-4-40	-4.0	22	15
07/23/08	A3	3-4-80	2.0	21	15
07/23/08	A3	3-4-120	1.0	19	15
08/08/08	A3	3-1-00	-1.4	13	15
08/08/08	A3	3-1-40	2.3	14	15
08/08/08	A3	3-1-80	-2.8	9	15
08/08/08	A3	3-1-120	-1.8	18	15
08/08/08	A3	3-1-160	0.8	18	15
08/08/08	A3	3-1-200	-1.9	24	15
08/08/08	A3	3-2-00	-9.2	11	15
08/08/08	A3	3-2-40	-4.9	17	15
08/08/08	A3	3-2-80	-4.3	14	15
08/08/08	A3	3-2-120	-1.8	18	15
08/08/08	A3	3-2-160	3.2	23	15
08/08/08	A3	3-2-200	-2.0	20	15
08/08/08	A3	3-3-00	-5.2	19	15
08/08/08	A3	3-3-40	-0.8	20	15
08/08/08	A3	3-3-80	-3.3	22	15
08/08/08	A3	3-3-120	5.6	23	15
08/08/08	A3	3-4-00	-7.7	21	45
08/08/08	A3	3-4-40	-6.4	24	15
08/08/08	A3	3-4-80	0.3	24	15
08/08/08	A3	3-4-120	-2.9	23	15
08/20/08	A3	3-1-00	-5.2	12	15
08/20/08	A3	3-1-40	-1.4	15	15
08/20/08	A3	3-1-80	-3.4	11	15
08/20/08	A3	3-1-120	-2.5	17	15
08/20/08	A3	3-1-160	-1.3	21	15
08/20/08	A3	3-1-200	-10.8	25	15
08/20/08	A3	3-2-00	-16.2	13	15
08/20/08	A3	3-2-40	4.5	14	15
08/20/08	A3	3-2-80	-5.2	15	15
08/20/08	A3	3-2-120	-8.6	18	15
08/20/08	A3	3-2-160	-2.4	23	30
08/20/08	A3	3-2-200	-5.5	20	15
08/20/08	A3	3-3-00	-17.8	20	15
08/20/08	A3	3-3-40	-7.2	19	15
08/20/08	A3	3-3-80	-8.6	20	15

**Wertheim NWR Water Management Demonstration Project Data Report**  
**Water Table Height and Pore Water Salinity**  
**2008**

Date	Area	Station	Water Table Depth (cm)	Soil Salinity (ppt)	Depth of Soil Salinity (cm)
08/20/08	A3	3-3-120	-8.9	22	30
08/20/08	A3	3-4-00	-22.9	20	45
08/20/08	A3	3-4-40	-21.5	24	30
08/20/08	A3	3-4-80	-14.8	25	15
08/20/08	A3	3-4-120	-5.3	25	15
09/04/08	A3	3-1-00	-0.8	11	15
09/04/08	A3	3-1-40	3.5	11	15
09/04/08	A3	3-1-80	-1.2	14	15
09/04/08	A3	3-1-120	0.2	18	30
09/04/08	A3	3-1-160	2.3	22	15
09/04/08	A3	3-1-200	1.2	24	15
09/04/08	A3	3-2-00	-0.8	14	15
09/04/08	A3	3-2-40	-2.7	15	15
09/04/08	A3	3-2-80	0.5	14	15
09/04/08	A3	3-2-120	0.9	16	15
09/04/08	A3	3-2-160	4.4	22	15
09/04/08	A3	3-2-200	-0.3	22	15
09/04/08	A3	3-3-00	-2.0	22	15
09/04/08	A3	3-3-40	1.6	19	15
09/04/08	A3	3-3-80	-0.4	23	15
09/04/08	A3	3-3-120	-5.9	26	15
09/04/08	A3	3-4-00	-0.9	25	15
09/04/08	A3	3-4-40	-3.0	22	30
09/04/08	A3	3-4-80	2.5	26	15
09/04/08	A3	3-4-120	1.3	23	30
09/18/08	A3	3-1-00	-1.8	14	15
09/18/08	A3	3-1-40	1.5	15	15
09/18/08	A3	3-1-80	-4.0	11	15
09/18/08	A3	3-1-120	-4.0	19	15
09/18/08	A3	3-1-160	-2.9	25	15
09/18/08	A3	3-1-200	-4.5	25	15
09/18/08	A3	3-2-00	-15.8	11	15
09/18/08	A3	3-2-40	1.5	16	30
09/18/08	A3	3-2-80	-5.8	15	15
09/18/08	A3	3-2-120	-2.9	18	15
09/18/08	A3	3-2-160	0.1	24	15
09/18/08	A3	3-2-200	-4.8	22	15
09/18/08	A3	3-3-00	-7.9	21	15
09/18/08	A3	3-3-40	-1.8	20	15
09/18/08	A3	3-3-80	-2.7	26	15
09/18/08	A3	3-3-120	-11.7	24	15
09/18/08	A3	3-4-00	-7.4	22	15
09/18/08	A3	3-4-40	-5.9	30	15
09/18/08	A3	3-4-80	0.5	27	15
09/18/08	A3	3-4-120	-6.5	27	15
10/24/08	A3	3-1-00	0.4	24	15
10/24/08	A3	3-1-40	3.8	23	15
10/24/08	A3	3-1-80	-0.1	15	15
10/24/08	A3	3-1-120	0.4	23	15
10/24/08	A3	3-1-160	2.5	26	15
10/24/08	A3	3-1-200	0.9	28	15
10/24/08	A3	3-2-00	-2.8	21	15

**Wertheim NWR Water Management Demonstration Project Data Report  
 Water Table Height and Pore Water Salinity  
 2008**

Date	Area	Station	Water Table Depth (cm)	Soil Salinity (ppt)	Depth of Soil Salinity (cm)
10/24/08	A3	3-2-40	4.4	20	15
10/24/08	A3	3-2-80	-5.4	18	15
10/24/08	A3	3-2-120	0.0	19	15
10/24/08	A3	3-2-160	3.9	26	15
10/24/08	A3	3-2-200	0.0	23	15
10/24/08	A3	3-3-00	-1.4	25	15
10/24/08	A3	3-3-40	1.0	27	15
10/24/08	A3	3-3-80	0.1	26	15
10/24/08	A3	3-3-120	-5.2	26	15
10/24/08	A3	3-4-00	-1.1	24	15
10/24/08	A3	3-4-40	-2.8	27	15
10/24/08	A3	3-4-80	2.9	27	15
10/24/08	A3	3-4-120	-0.3	25	15

Wertheim NWR Water Management Demonstration Project Data Report  
Water Table Height and Pore Water Salinity  
2008

Date	Area	Station	Water Table Depth (cm)	Soil Salinity (ppt)	Depth of Soil Salinity (cm)
Area 4					
05/22/08	A4	4-1-00	----	14	15
05/22/08	A4	4-1-40	-2.4	7	15
05/22/08	A4	4-1-80	3.5	19	15
05/22/08	A4	4-1-120	4.0	20	15
05/22/08	A4	4-1-160	-5.2	19	15
05/22/08	A4	4-2-00	2.3	17	15
05/22/08	A4	4-2-40	1.7	15	15
05/22/08	A4	4-2-80	0.7	19	15
05/22/08	A4	4-2-120	-0.4	20	15
05/22/08	A4	4-2-160	2.7	26	15
05/22/08	A4	4-3-00	4.0	16	15
05/22/08	A4	4-3-40	1.3	26	15
05/22/08	A4	4-3-80	-4.0	17	15
05/22/08	A4	4-3-120	0.7	23	15
05/22/08	A4	4-3-160	7.9	25	15
05/22/08	A4	4-4-00	----	15	15
05/22/08	A4	4-4-40	5.7	2	15
05/22/08	A4	4-4-80	2.3	18	15
05/22/08	A4	4-4-120	2.5	20	15
05/22/08	A4	4-4-160	2.0	18	15
05/29/08	A4	4-1-00	Top of well stuck	17	15
05/29/08	A4	4-1-40	-3.3	7	15
05/29/08	A4	4-1-80	-3.5	22	15
05/29/08	A4	4-1-120	-1.0	24	15
05/29/08	A4	4-1-160	-20.6	15	15
05/29/08	A4	4-2-00	-12.8	19	15
05/29/08	A4	4-2-40	-10.7	20	15
05/29/08	A4	4-2-80	-5.4	21	15
05/29/08	A4	4-2-120	-4.5	20	15
05/29/08	A4	4-2-160	-6.3	25	15
05/29/08	A4	4-3-00	2.3	25	15
05/29/08	A4	4-3-40	-1.8	25	15
05/29/08	A4	4-3-80	-1.0	20	15
05/29/08	A4	4-3-120	-17.3	20	15
05/29/08	A4	4-3-160	4.6	24	45
05/29/08	A4	4-4-00	1.8	17	15
05/29/08	A4	4-4-40	-2.7	8	15
05/29/08	A4	4-4-80	-3.2	20	15
05/29/08	A4	4-4-120	-1.4	25	15
05/29/08	A4	4-4-160	-17.6	18	15
06/12/08	A4	4-1-00	----	10.0	15
06/12/08	A4	4-1-40	-7.6	7	15
06/12/08	A4	4-1-80	-10.8	20	15
06/12/08	A4	4-1-120	-9.9	20	15
06/12/08	A4	4-1-160	-22.6	15	15
06/12/08	A4	4-2-00	-5.9	18	15
06/12/08	A4	4-2-40	-13.3	17	15
06/12/08	A4	4-2-80	-14.5	20	15
06/12/08	A4	4-2-120	-8.2	19	15
06/12/08	A4	4-2-160	Well is buried	28	15
06/12/08	A4	4-3-00	-3.8	14	15

Wertheim NWR Water Management Demonstration Project Data Report  
Water Table Height and Pore Water Salinity  
2008

Date	Area	Station	Water Table Depth (cm)	Soil Salinity (ppt)	Depth of Soil Salinity (cm)
06/12/08	A4	4-3-40	-8.8	23	15
06/12/08	A4	4-3-80	Top of well stuck	19	15
06/12/08	A4	4-3-120	-19.2	21	15
06/12/08	A4	4-3-160	-0.4	26	30
06/12/08	A4	4-4-00	1.4	16	15
06/12/08	A4	4-4-40	Flooded	4	15
06/12/08	A4	4-4-80	-6.6	20	15
06/12/08	A4	4-4-120	-7.2	25	15
06/12/08	A4	4-4-160	-17.0	17	15
06/25/08	A4	4-1-00	1.8	5	15
06/25/08	A4	4-1-40	-4.3	2	30
06/25/08	A4	4-1-80	-3.6	20	15
06/25/08	A4	4-1-120	-4.7	20	15
06/25/08	A4	4-1-160	-18.2	16	15
06/25/08	A4	4-2-00	-20.5	16	15
06/25/08	A4	4-2-40	-9.0	16	15
06/25/08	A4	4-2-80	-7.5	20	15
06/25/08	A4	4-2-120	-5.6	20	15
06/25/08	A4	4-2-160	-1.5	29	15
06/25/08	A4	4-3-00	-0.8	12	15
06/25/08	A4	4-3-40	-2.4	21	15
06/25/08	A4	4-3-80	-0.3	22	15
06/25/08	A4	4-3-120	-17.3	18	45
06/25/08	A4	4-3-160	3.9	25	15
06/25/08	A4	4-4-00	4.1	9	15
06/25/08	A4	4-4-40	-1.3	4	15
06/25/08	A4	4-4-80	-2.2	19	15
06/25/08	A4	4-4-120	-0.9	23	15
06/25/08	A4	4-4-160	-10.5	16	15
07/09/08	A4	4-1-00	2.8	2	15
07/09/08	A4	4-1-40	-8.7	1	45
07/09/08	A4	4-1-80	1.5	17	15
07/09/08	A4	4-1-120	0.5	20	15
07/09/08	A4	4-1-160	-10.7	15	15
07/09/08	A4	4-2-00	-4.5	14	15
07/09/08	A4	4-2-40	0.4	15	30
07/09/08	A4	4-2-80	-10.1	17	15
07/09/08	A4	4-2-120	-16.4	16	45
07/09/08	A4	4-2-160	-7.1	26	45
07/09/08	A4	4-3-00	0.6	14	15
07/09/08	A4	4-3-40	-1.7	20	15
07/09/08	A4	4-3-80	0.3	18	15
07/09/08	A4	4-3-120	-13.7	17	15
07/09/08	A4	4-3-160	2.4	24	30
07/09/08	A4	4-4-00	2.9	2	30
07/09/08	A4	4-4-40	1.6	1	30
07/09/08	A4	4-4-80	-1.4	16	15
07/09/08	A4	4-4-120	0.6	20	15
07/09/08	A4	4-4-160	-1.5	15	15
07/21/08	A4	4-1-00	2.4	6	15
07/21/08	A4	4-1-40	-1.9	3	15
07/21/08	A4	4-1-80	2.7	17	15

**Wertheim NWR Water Management Demonstration Project Data Report**  
**Water Table Height and Pore Water Salinity**  
**2008**

Date	Area	Station	Water Table Depth (cm)	Soil Salinity (ppt)	Depth of Soil Salinity (cm)
07/21/08	A4	4-1-120	3.6	17	15
07/21/08	A4	4-1-160	-4.0	16	15
07/21/08	A4	4-2-00	1.3	15	15
07/21/08	A4	4-2-40	0.9	17	15
07/21/08	A4	4-2-80	1.3	17	15
07/21/08	A4	4-2-120	-2.3	16	15
07/21/08	A4	4-2-160	6.3	24	15
07/21/08	A4	4-3-00	1.9	16	15
07/21/08	A4	4-3-40	0.9	21	15
07/21/08	A4	4-3-80	0.2	18	15
07/21/08	A4	4-3-120	-1.8	15	15
07/21/08	A4	4-3-160	6.8	21	15
07/21/08	A4	4-4-00	7.1	0	15
07/21/08	A4	4-4-40	5.2	0	15
07/21/08	A4	4-4-80	0.8	16	15
07/21/08	A4	4-4-120	2.7	17	15
07/21/08	A4	4-4-160	0.9	16	15
08/07/08	A4	4-1-00	3.1	1	15
08/07/08	A4	4-1-40	-2.6	6	15
08/07/08	A4	4-1-80	3.4	18	15
08/07/08	A4	4-1-120	1.1	19	15
08/07/08	A4	4-1-160	-7.2	17	15
08/07/08	A4	4-2-00	-1.1	15	15
08/07/08	A4	4-2-40	0.5	16	15
08/07/08	A4	4-2-80	0.2	18	15
08/07/08	A4	4-2-120	-2.1	17	15
08/07/08	A4	4-2-160	5.7	26	15
08/07/08	A4	4-3-00	0.6	21	15
08/07/08	A4	4-3-40	0.1	19	15
08/07/08	A4	4-3-80	0.0	17	15
08/07/08	A4	4-3-120	-10.8	14	15
08/07/08	A4	4-3-160	7.1	22	15
08/07/08	A4	4-4-00	7.9	1	15
08/07/08	A4	4-4-40	3.7	1	15
08/07/08	A4	4-4-80	-0.3	17	15
08/07/08	A4	4-4-120	0.7	18	15
08/07/08	A4	4-4-160	-1.4	16	15
08/21/08	A4	4-1-00	0.2	2	15
08/21/08	A4	4-1-40	-5.4	3	15
08/21/08	A4	4-1-80	-2.5	19	15
08/21/08	A4	4-1-120	-4.6	21	30
08/21/08	A4	4-1-160	-20.1	14	30
08/21/08	A4	4-2-00	-10.2	17	15
08/21/08	A4	4-2-40	-9.0	16	15
08/21/08	A4	4-2-80	-13.4	20	15
08/21/08	A4	4-2-120	-14.8	16	15
08/21/08	A4	4-2-160	-19.8	28	30
08/21/08	A4	4-3-00	-2.2	20	15
08/21/08	A4	4-3-40	-3.1	20	15
08/21/08	A4	4-3-80	-1.6	18	15
08/21/08	A4	4-3-120	-16.5	17	15
08/21/08	A4	4-3-160	-6.5	21	15



Wertheim NWR Water Management Demonstration Project Data Report  
Water Table Height and Pore Water Salinity  
2008

Date	Area	Station	Water Table Depth (cm)	Soil Salinity (ppt)	Depth of Soil Salinity (cm)
08/21/08	A4	4-4-00	0.9	3	15
08/21/08	A4	4-4-40	-4.2	2	45
08/21/08	A4	4-4-80	-3.1	16	15
08/21/08	A4	4-4-120	-1.1	21	15
08/21/08	A4	4-4-160	-17.2	10	45
09/05/08	A4	4-1-00	2.0	3	15
09/05/08	A4	4-1-40	-2.8	7	15
09/05/08	A4	4-1-80	2.2	20	15
09/05/08	A4	4-1-120	-2.2	19	15
09/05/08	A4	4-1-160	-13.6	17	15
09/05/08	A4	4-2-00	-5.6	16	15
09/05/08	A4	4-2-40	-2.7	16	15
09/05/08	A4	4-2-80	-1.3	19	15
09/05/08	A4	4-2-120	-3.8	18	15
09/05/08	A4	4-2-160	-0.3	34	15
09/05/08	A4	4-3-00	-0.9	20	15
09/05/08	A4	4-3-40	-1.0	23	15
09/05/08	A4	4-3-80	-0.8	22	15
09/05/08	A4	4-3-120	-14.4	20	15
09/05/08	A4	4-3-160	5.4	23	15
09/05/08	A4	4-4-00	2.7	0	15
09/05/08	A4	4-4-40	-0.4	1	45
09/05/08	A4	4-4-80	-10.4	16	15
09/05/08	A4	4-4-120	0.8	21	15
09/05/08	A4	4-4-160	-10.9	18	15
09/19/08	A4	4-1-00	2.0	5	15
09/19/08	A4	4-1-40	-5.6	3	15
09/19/08	A4	4-1-80	-10.8	20	15
09/19/08	A4	4-1-120	-9.7	22	30
09/19/08	A4	4-1-160	-17.4	17	15
09/19/08	A4	4-2-00	-13.0	18	15
09/19/08	A4	4-2-40	-9.0	19	15
09/19/08	A4	4-2-80	-8.0	24	15
09/19/08	A4	4-2-120	-9.7	22	15
09/19/08	A4	4-2-160	-5.3	35	15
09/19/08	A4	4-3-00	-2.4	24	15
09/19/08	A4	4-3-40	-4.2	20	15
09/19/08	A4	4-3-80	-1.6	21	15
09/19/08	A4	4-3-120	-16.4	19	15
09/19/08	A4	4-3-160	4.7	26	15
09/19/08	A4	4-4-00	1.6	3	15
09/19/08	A4	4-4-40	-2.3	4	15
09/19/08	A4	4-4-80	-2.4	19	15
09/19/08	A4	4-4-120	-2.7	21	15
09/19/08	A4	4-4-160	-15.0	17	15
10/20/08	A4	4-1-00	3.9	6	15
10/20/08	A4	4-1-40	-1.1	4	15
10/20/08	A4	4-1-80	3.9	27	15
10/20/08	A4	4-1-120	4.6	24	15
10/20/08	A4	4-1-160	7.6	21	15
10/20/08	A4	4-2-00	1.7	20	15
10/20/08	A4	4-2-40	3.6	21	15

**Wertheim NWR Water Management Demonstration Project Data Report  
 Water Table Height and Pore Water Salinity  
 2008**

Date	Area	Station	Water Table Depth (cm)	Soil Salinity (ppt)	Depth of Soil Salinity (cm)
10/20/08	A4	4-2-80	0.7	25	15
10/20/08	A4	4-2-120	-1.9	20	15
10/20/08	A4	4-2-160	6.6	34	15
10/20/08	A4	4-3-00	4.0	19	15
10/20/08	A4	4-3-40	4.5	24	15
10/20/08	A4	4-3-80	3.4	26	15
10/20/08	A4	4-3-120	5.8	22	15
10/20/08	A4	4-3-160	6.3	24	15
10/20/08	A4	4-4-00	18.3	24	15
10/20/08	A4	4-4-40	-3.7	23	15
10/20/08	A4	4-4-80	4.0	20	15
10/20/08	A4	4-4-120	7.7	3	30
10/20/08	A4	4-4-160	2.7	5	15

## **Appendix B**

### **Vegetation Quadrats 2008**



Wertheim NWR Water Management Demonstration Project Data Report  
Vegetation Quadrats

2008																																						
Plot ID	Study Site	Base Ground	Phragmites australis	P. australis (dead)	Distichlis spicata	D. spicata (dead)	Najas	A. fluviatilis	A. fluviatilis (dead)	Limnium carolinianum	Aster nemoralis	Aster subulatus	Schizoclelea robustus	S. robustus (dead)	Puccia purpureosens	Solidago sempervirens	S. sempervirens (dead)	Schizoclelea purgens	S. purgens (dead)	Spartina patens	S. patens (dead)	Eleocharis perfoliata	E. perfoliata (dead)	Salicornia sp.	Polygnum hydropiperoides	Spartina cynosuroides	S. cynosuroides (dead)	Spartina alterniflora	S. alterniflora (dead)	Polygnum ramissimum	Cyperus filiformis	Algae	Water	Flitch	Muck	Othercom		
Area 1																																						
1-1-00	1		6	5										37	13			31	12	49	44						17	1										
1-1-40	1	25			3						2			5				30	4	39	24	1																
1-1-80	1	1												18	3					47	50																	
1-1-120	1				34	22	1										3		7	1	49	50																
1-2-00	1		3	3										25	9	3		14	18	50	49								8	2								
1-2-40	1				5															50	50																	
1-2-80	1				24	17							1	5	1		4		1	50	50			5														
1-2-120	1		1	10										6						50	50								1									
1-3-00	1	2														11		14	46	48	48						2	2										
1-3-40	1		8	6	2															50	50																	
1-3-80	1				1									3	2			3	6	48	48														2			
1-3-120	1				5	2												4		50	50																	
1-3-160	1				2												2			50	50																	
1-3-200	1	14	14	18	28	28								1	3	8			1								19	24										
1-4-00	1			23											1	6		4	48	44	44												2					
1-4-40	1				10	4	4											38	29	48	48																	
1-4-80	1				11	4								4	1	2				43	38	4	10								4							
1-4-120	1				21	20										1				44	42																	
1-4-160	1				14	2											4	18	18	50	50																	
1-4-200	1				2												10	34	47	47	49																	
1-4-240	1																17	8	3	48	50							42	27									
1-5-00	1		13	8	4											27	4	33	28	40	32																	
1-5-40	1																			50	50																	
1-5-80	1																			50	50																	

Wertheim NWR Water Management Demonstration Project Data Report  
Vegetation Quadrats

2008																																								
Plot ID	Study Site	Base Ground	Phragmites australis	P. australis (dead)	Distichlis spicata	D. spicata (dead)	N. furcatus	A. furcatus - C2 in	A. furcatus (dead)	Eleocharis acicularis	Aster nemoralis	Aster subulatus	Schizoglossus robustus	S. robustus (dead)	Rudbeckia purpurea	Solidago sempervirens	S. sempervirens (dead)	Schizoglossus purpureus	S. purpureus (dead)	Spartina patens	S. patens (dead)	Eleocharis parvula	E. parvula (dead)	Salicornia sp.	Polygnum hydropyramides	Spartina cynosuroides	S. cynosuroides (dead)	Spartina alterniflora	S. alterniflora (dead)	Polygnum ramosissimum	Cyperus filiformis	Algae	Water	Flitch	Muck	Unknown				
Area 2																																								
2-1-00	2						2										15	41	19	50	50																			
2-1-40	2	4																	10	5								50	23											
2-1-80	2	10																		28	28							44	47							3				
2-1-120	2																			50	50																			
2-1-160	2																			50	50																			
2-2-00	2			1									31					49	50	49																				
2-2-40	2	1											2		5			40	41	25	6							4								18				
2-2-80	2	46																	3	7	7	4																		
2-2-120	2	27																	28	25								3							4					
2-2-160	2																		50	50								38												
2-2-200	2							1									19		4	50	50																			
2-3-00	2		14	14																18	12							50	11											
2-3-40	2	16																		39	16				2												2			
2-3-80	2	50																																						
2-3-120	2																			50	50								49											
2-3-160	2																			50	50								50											
2-3-200	2																												50											
2-4-00	2	13						1												49	34				2				4											
2-4-40	2	6																		48	45								43											
2-4-80	2																			50	50								50											
2-4-120	2		15	33			33	3					6	3						43	31																			
2-5-00	2		11	6			2													48	50								23											
2-5-40	2																			50	50								14											
2-5-80	2			1	4															50	50								12											



Wertheim NWR Water Management Demonstration Project Data Report  
Vegetation Quadrats

		2008																																				
Plot ID	Study Site	Bare Ground	<i>Phragmites australis</i>	<i>P. australis</i> (dead)	<i>Distichis spicata</i>	<i>D. spicata</i> (dead)	<i>Najas</i>	<i>A. furcatus</i> <2 in	<i>A. furcatus</i> (dead)	<i>Limnium carolinianum</i>	<i>Aster nemoralis</i>	<i>Aster subulatus</i>	<i>Schizoglossus robustus</i>	<i>S. robustus</i> (dead)	<i>Puccia purpureosens</i>	<i>Solidago sempervirens</i>	<i>S. sempervirens</i> (dead)	<i>Schizoglossus purpureus</i>	<i>S. purpureus</i> (dead)	<i>Spargina patens</i>	<i>S. patens</i> (dead)	<i>Eleocharis parvula</i>	<i>E. parvula</i> (dead)	<i>Salicornia</i> sp.	<i>Polygonum hydropurpureus</i>	<i>Spargina cynosuroides</i>	<i>S. cynosuroides</i> (dead)	<i>Spargina alterniflora</i>	<i>S. alterniflora</i> (dead)	<i>Polygonum ramosissimum</i>	<i>Cyperus filiformis</i>	Algae	Water	Rich	Wack	Unknown		
Area 3																																						
3-1-00	3	31		1	9														1										1									
3-1-40	3																		28	50	50																	
3-1-80	3		1	47	37											4	26	18	41	3									10									
3-1-120	3																	9	5	50	50																	
3-1-160	3																		49	50									47	1								
3-1-200	3																		48	50					1				32									
3-2-00	3												3			50		7		1									5							11		
3-2-40	3																		50	50																		
3-2-80	3		11	9				1		7									11	11									13	3					40			
3-2-120	3																		48	48									48									
3-2-160	3																		50	50																		
3-2-200	3																		49	48									23									
3-3-00	3																		50	50									35									
3-3-40	3																		50	50																		
3-3-80	3	1																	29	20																		
3-3-120	3	1	22	20				23		3																	33	18	48	34								
																													30	2								
3-4-00	3	1	2	4																									50	50								
3-4-40	3																		2		50	50																
3-4-80	3																			50	50								40									
3-4-120	3	2																	48	48									50									

Wertheim NWR Water Management Demonstration Project Data Report  
Vegetation Quadrats

		2008																																					
Plot ID	Study Site	Base Ground	<i>Phragmites australis</i>	<i>P. australis</i> (dead)	<i>Distichlis spicata</i>	<i>D. spicata</i> (dead)	<i>N. triflorus</i>	<i>A. furcatus</i> <2 in	<i>A. furcatus</i> (dead)	<i>Littoridin</i> <i>Carolinianum</i>	<i>Aster nemoralis</i>	<i>Aster subulatus</i>	<i>Schomolckia robustus</i>	<i>S. robustus</i> (dead)	<i>Puccia purpurascens</i>	<i>Solidago sempervirens</i>	<i>S. sempervirens</i> (dead)	<i>Schomolckia pungens</i>	<i>S. pungens</i> (dead)	<i>Spartina patens</i>	<i>S. patens</i> (dead)	<i>Zenclatis parvula</i>	<i>Z. parvula</i> (dead)	<i>Salicornia</i> sp.	<i>Polygonum hydropiperoides</i>	<i>Spartina cynosuroides</i>	<i>S. cynosuroides</i> (dead)	<i>Spartina alterniflora</i>	<i>S. alterniflora</i> (dead)	<i>Polygonum ramosissimum</i>	<i>Cyperus filiformis</i>	Algae	Ascor	Pitch	Black	Unknown			
Area 4																																							
4-1-00	4	6																		47	43								19										
4-1-40	4				4															50	50																		
4-1-80	4																			50	50																		
4-1-120	4																			50	50								47	2									
4-1-160	4	2	2																	49	4					18		30											
4-2-00	4																			50	50																		
4-2-40	4	2																		41	50																		
4-2-80	4				10															50	50																		
4-2-120	4				3															12									8									50	
4-2-160	4																											50											
4-3-00	4	5																		49	49							17	3										
4-3-40	4				2															50	50							47											
4-3-80	4																			50	50																		
4-3-120	4		1		3		1													50	50																		
4-3-160	4	11																										32							20	2			
4-4-00	4		1	29									13	44	3					30	5											1						4	
4-4-40	4		24	31					3							2				50	14																		
4-4-80	4				29															47	50																		
4-4-120	4	1			1															50	48				2														
4-4-160	4	14	48	36			4								18										14														

## **Appendix C**

### **Vegetation Biomass 2008**



**Wertheim NWR Water Management Demonstration Project Data Report**  
**Vegetation Biomass**  
**2008**

Date	Area	Sample Location	Above Ground LIVE			Above Ground Dead		
			Weight(g)			Weight(g)		
			Live Vegetation	Pre-Heat	Post-Heat	Dead Vegetation	Pre-Heat	Post-Heat
<b>Area 1</b>								
10/14/2008	1	2-00	23	60	37	23	73	50
10/14/2008	1	2-40*	0	22	22	16	55	39
10/14/2008	1	2-80	20	53	33	23	54	31
10/14/2008	1	2-120	14	41	27	49	128	79
10/14/2008	1	3-00	20	44	24	47	88	41
10/14/2008	1	3-40	17	45	28	15	47	32
10/14/2008	1	3-80	19	48	29	23	73	50
10/14/2008	1	3-120	17	50	33	20	67	47
10/14/2008	1	3-160	27	75	48	40	90	50
10/14/2008	1	4-80	43	130	87	33	80	47
10/14/2008	1	4-120	11	23	12	27	60	33
10/14/2008	1	4-160	17	49	32	19	46	27
10/14/2008	1	5-00	14	22	8	56	82	26
* The 1-2-40 sample was lost on the marsh and found on 10/15/08.								
<b>Area 2</b>								
10/23/2008	2	1-40	37	85	48	36	76	40
10/23/2008	2	1-120	11	35	24	41	91	50
10/23/2008	2	1-160	6	30	24	13	53	40
10/23/2008	2	2-00	30	70	40	21	57	36
10/23/2008	2	2-40	11	36	25	26	81	55
10/23/2008	2	2-80	10	32	22	18	46	28
10/23/2008	2	3-40	7.5	15	7.5	----	NONE-ALL ALIVE	
10/23/2008	2	3-80	28	54	26	39	73	34
10/23/2008	2	3-120	34	82	48	35	78	43
10/23/2008	2	4-40	23	54	31	60	145	85
10/23/2008	2	4-80	29	64	35	83	135	52
10/23/2008	2	5-00	32	90	58	41	136	95
10/23/2008	2	5-40	17	52	35	31	80	49
10/23/2008	2	5-80	30	101	71	34	115	81
<b>Area 3</b>								
10/6/2008	3	1-00	12	18	6	9	17	8
10/6/2008	3	1-80	16	24	8	21	31	10
10/6/2008	3	1-200	21	38	17	58	90	32
10/6/2008	3	2-80	21	43	22	110	206	96
10/6/2008	3	2-120	20	39	19	41	70	29
10/6/2008	3	2-160	5	16	11	47	108	61
10/6/2008	3	2-200	29	69	40	38	65	27
10/6/2008	3	3-40	26	58	32	75	136	61
10/6/2008	3	3-120	57	97	40	72	96	24
10/6/2008	3	4-80	25	40	15	117	149	32
<b>Area 4</b>								
9/25/08	4	1-40	7	17	10	18	47	29
9/25/08	4	2-80	11	24	13	32	74	42
9/25/08	4	3-00	22	44	22	43	113	70
9/25/08	4	3-40	5	14	9	39	69	30
9/25/08	4	4-80	18	46	28	19	49	30
9/25/08	4	4-120	10	25	15	17	57	40

**Wertheim NWR Water Management Demonstration Project Data Report**  
**Soil Core**  
**2008**

Date	Area	Sample Location	Soil Core Length (cm)	Soil Core Weight (g)	Weight(g)	
					Pre-Heat	Post-Heat
Area 1						
10/14/2008	1	3-200	18.0	64	202	138
10/14/2008	1	4-80	19.0	69	220	151
10/14/2008	1	4-160	17.5	72	266	194
10/14/2008	1	4-200	16.0	41	229	188
10/14/2008	1	4-240	21.0	105	327	222
10/14/2008	1	5-00	14.5	22	104	82
Area 2						
10/23/2008	2	1-00	16.0	78	239	161
10/23/2008	2	1-40	19.0	87	174	87
10/23/2008	2	2-00	18.0	116	233	117
10/23/2008	2	2-80	20.0	100	360	260
10/23/2008	2	5-40	18.0	108	234	126
Area 3						
10/6/2008	3	1-00	17.5	126	214	88
10/6/2008	3	1-80	16.0	103	177	74
10/6/2008	3	1-120	20.0	84	199	115
10/6/2008	3	1-160	16.5	167	294	127
10/6/2008	3	1-200	20.0	104	289	185
Area 4						
9/25/08	4	1-40	19.0	106	180	74
9/25/08	4	2-80	19.0	108	181	73
9/25/08	4	3-00	21.5	108	142	34
9/25/08	4	3-40	27.0	169	294	125
9/25/08	4	4-80	17.5	124	239	115
9/25/08	4	4-120	17.5	95	162	67

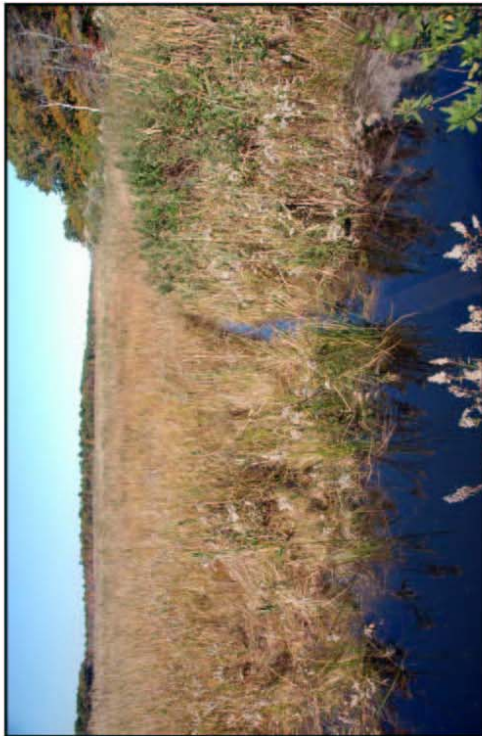
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## **Appendix D**

### **Vegetation Photographs 2008**







2008 Area 1 Pt. 1 N



2008 Area 1 Pt. 1 E



2008 Area 1 Pt. 1 S



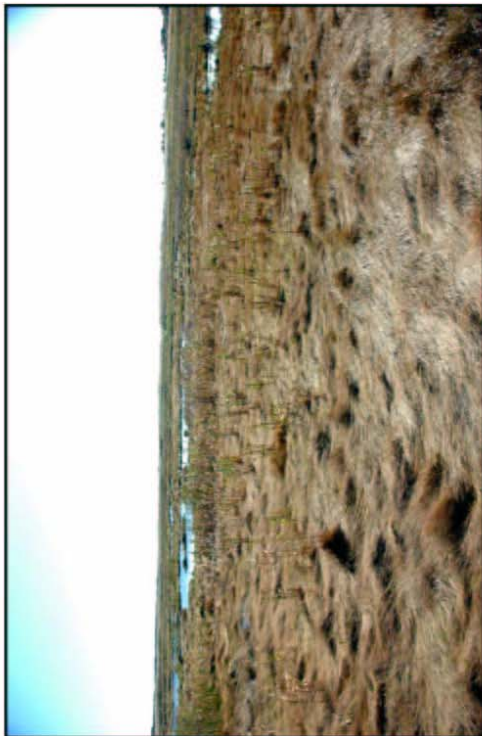
2008 Area 1 Pt. 1 W



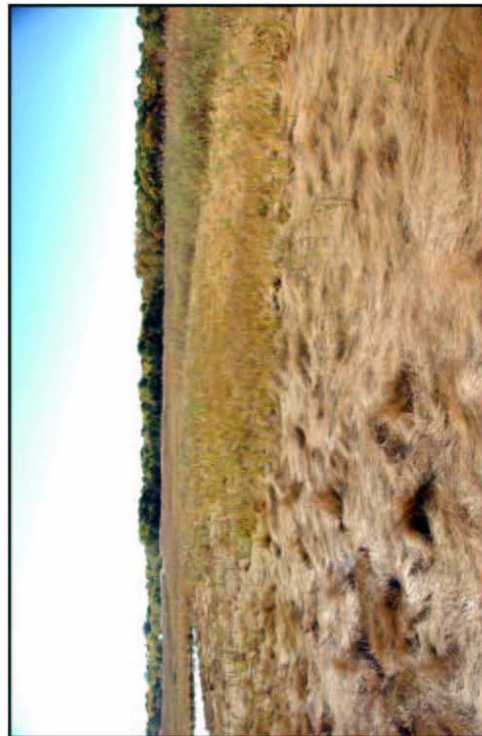
2008 Area 1 Pt. 3 N



2008 Area 1 Pt. 3 E



2008 Area 1 Pt. 3 S



2008 Area 1 Pt. 3 W





2008 Area 1 Pt. 4 N



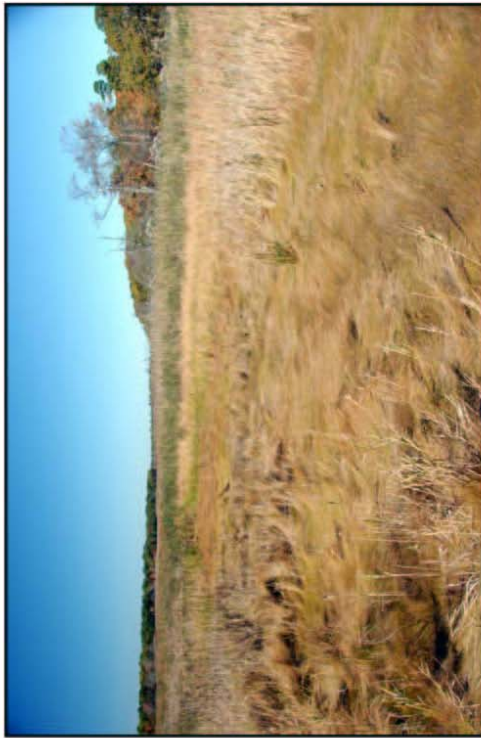
2008 Area 1 Pt. 4 E



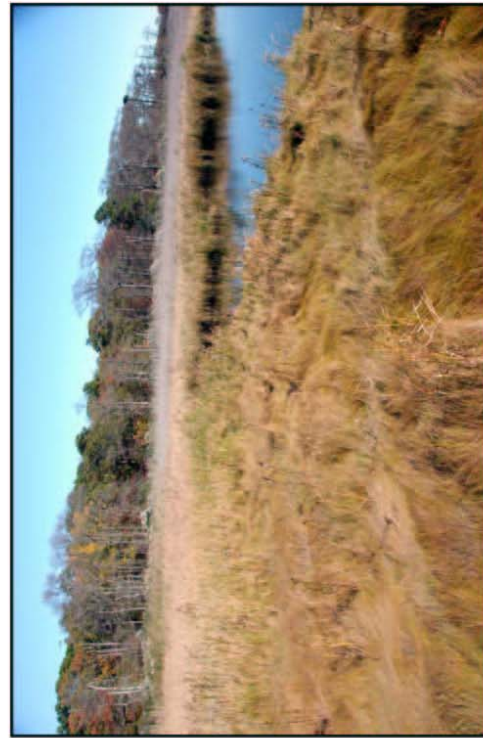
2008 Area 1 Pt. 4 S



2008 Area 1 Pt. 4 W



2008 Area 1 Pt. 5 N



2008 Area 1 Pt. 5 E



2008 Area 1 Pt. 5 S



2008 Area 1 Pt. 5 W





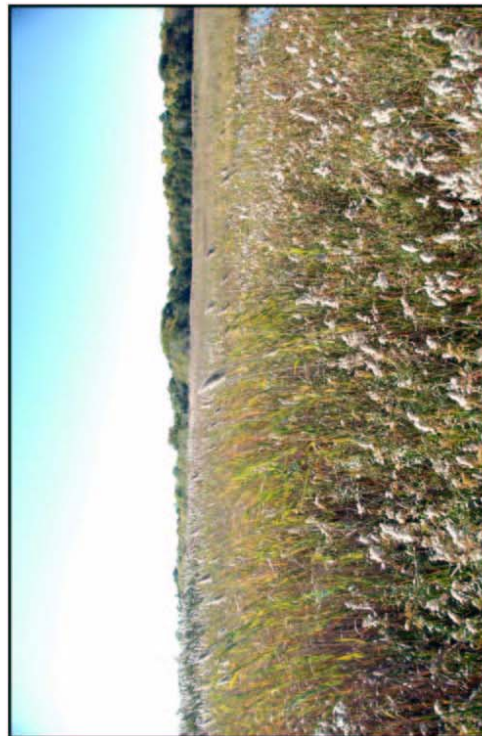
2008 Area 1 Pt. 6 N



2008 Area 1 Pt. 6 E



2008 Area 1 Pt. 6 S



2008 Area 1 Pt. 6 W



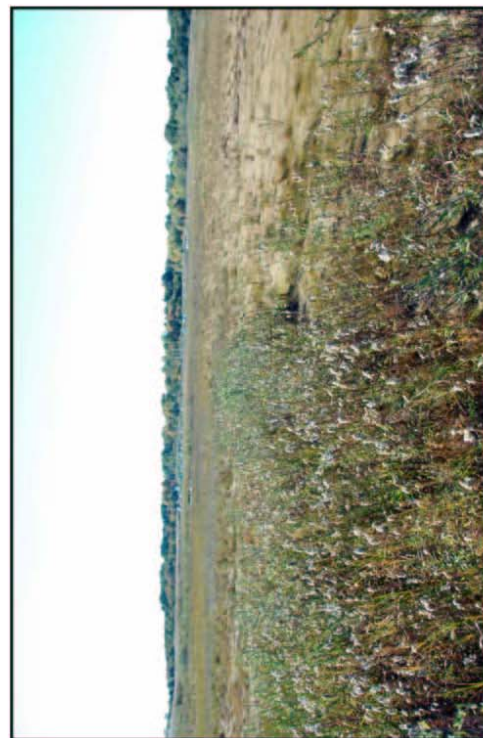
2008 Area 1 Pt. 7 N



2008 Area 1 Pt. 7 E



2008 Area 1 Pt. 7 S



2008 Area 1 Pt. 7 W

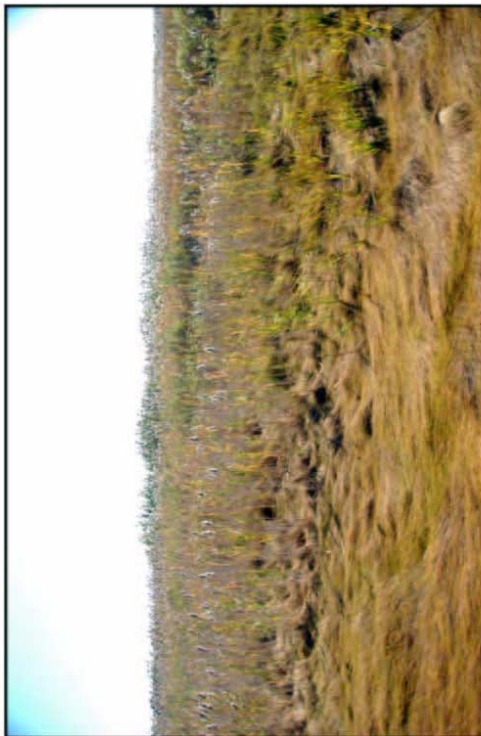




2008 Area 1 Pt. 8 N



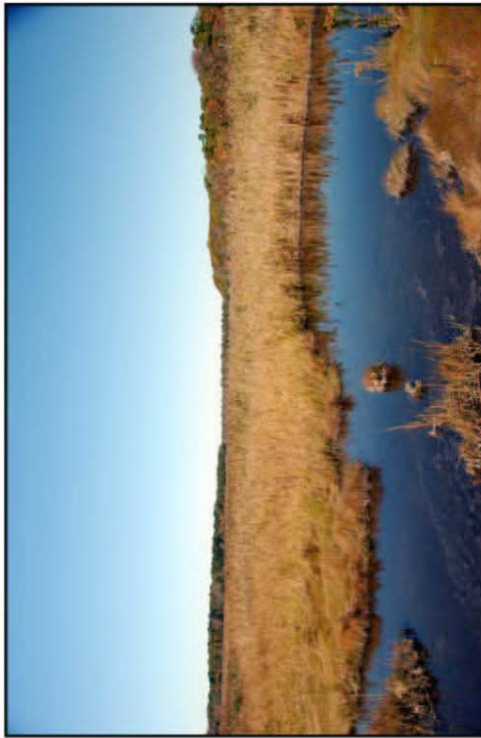
2008 Area 1 Pt. 8 E



2008 Area 1 Pt. 8 S



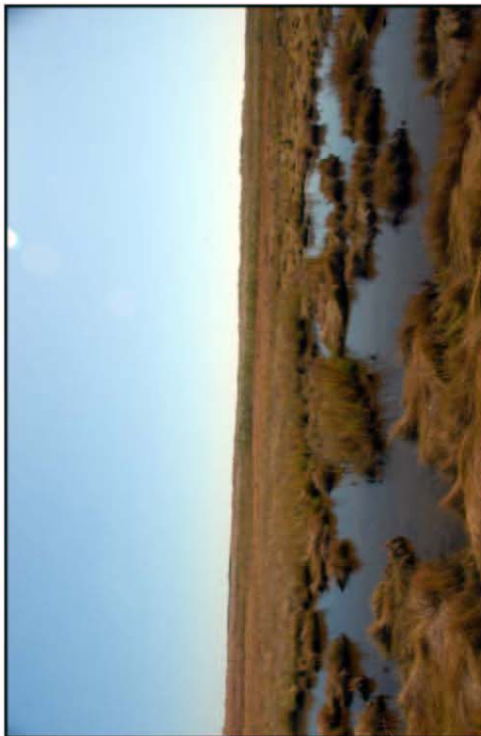
2008 Area 1 Pt. 8 W



2008 Area 1 Pt. 9 N



2008 Area 1 Pt. 9 E



2008 Area 1 Pt. 9 S

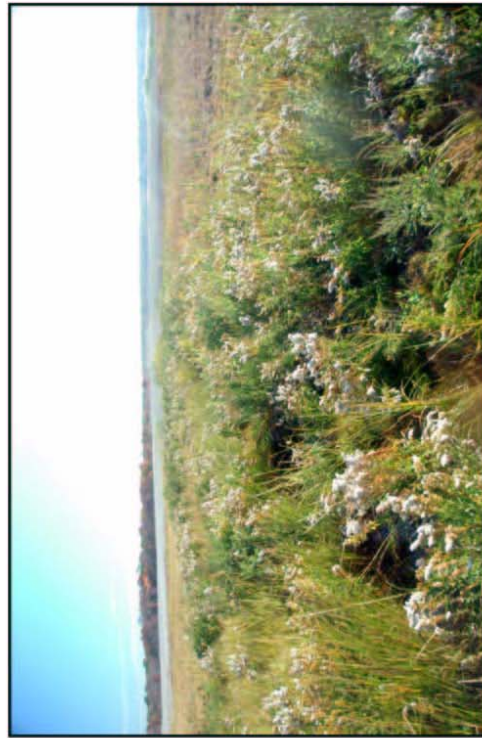


2008 Area 1 Pt. 9 W





2008 Area 2 Pt. 1 N



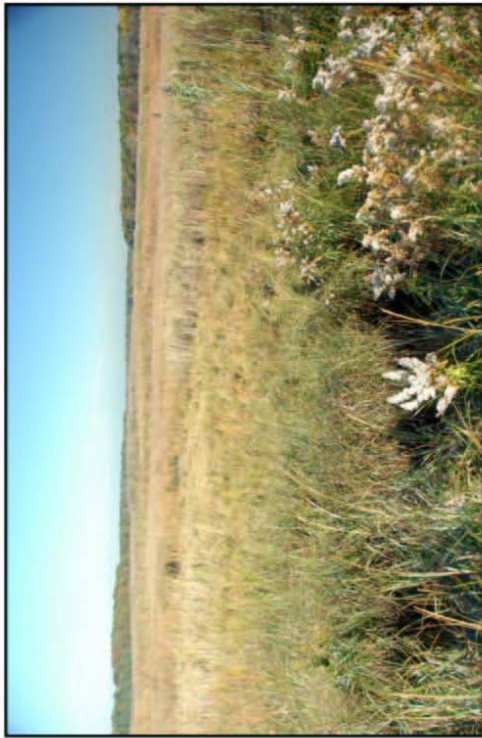
2008 Area 2 Pt. 1 E



2008 Area 2 Pt. 1 S



2008 Area 2 Pt. 1 W



2008 Area 2 Pt. 2 N



2008 Area 2 Pt. 2 E

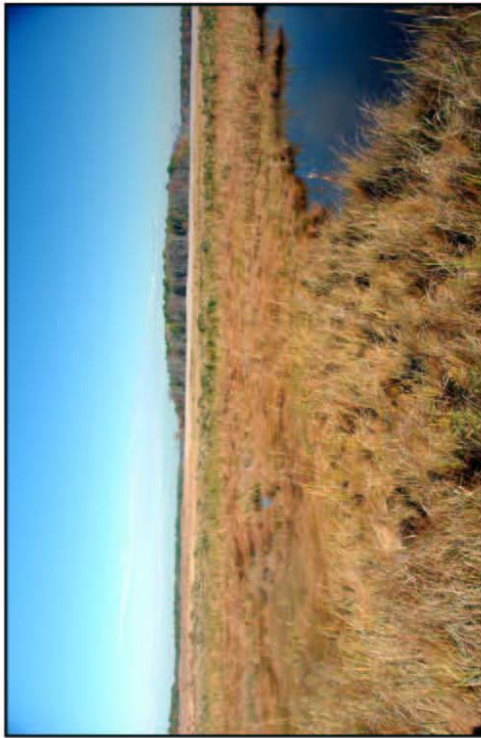


2008 Area 2 Pt. 2 S

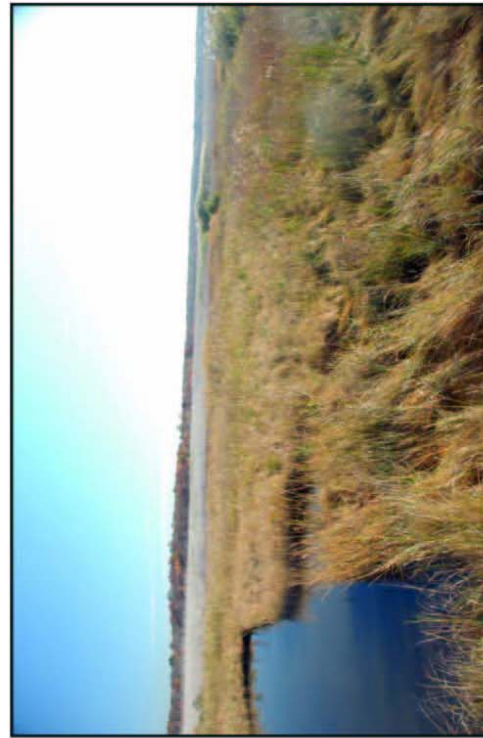


2008 Area 2 Pt. 2 W





2008 Area 2 Pt. 3 N



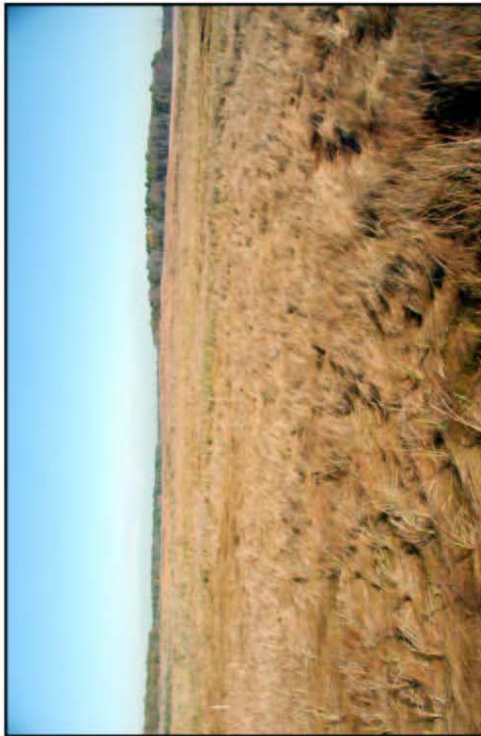
2008 Area 2 Pt. 3 E



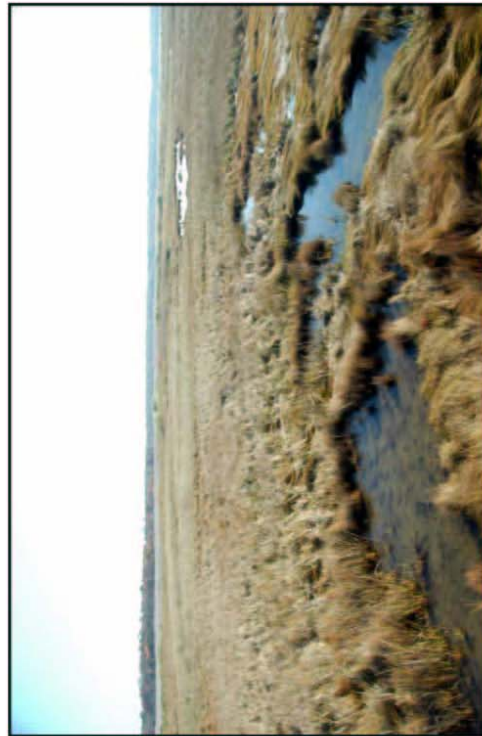
2008 Area 2 Pt. 3 S



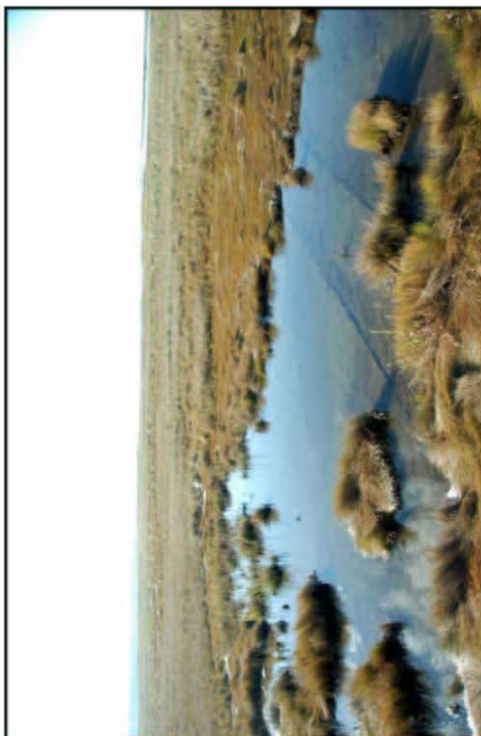
2008 Area 2 Pt. 3 W



2008 Area 2 Pt. 4 N



2008 Area 2 Pt. 4 E

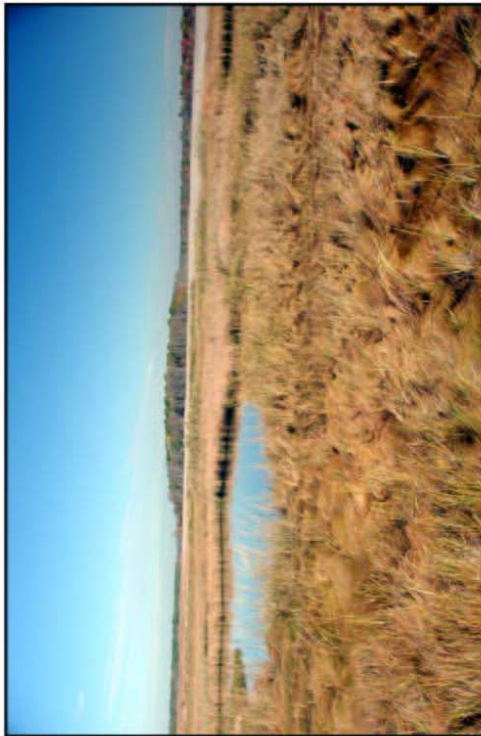


2008 Area 2 Pt. 4 S

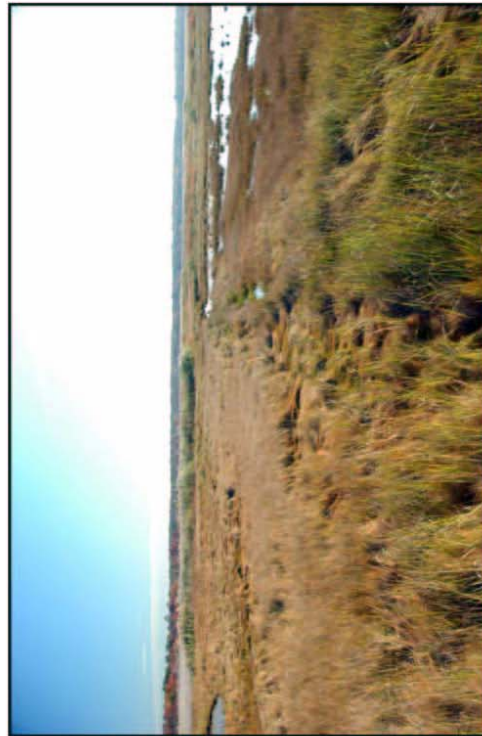


2008 Area 2 Pt. 4 W





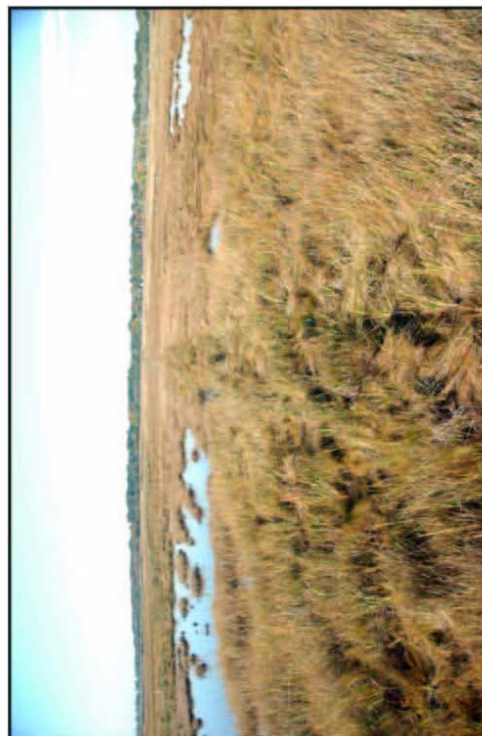
2008 Area 2 Pt. 5 N



2008 Area 2 Pt. 5 E

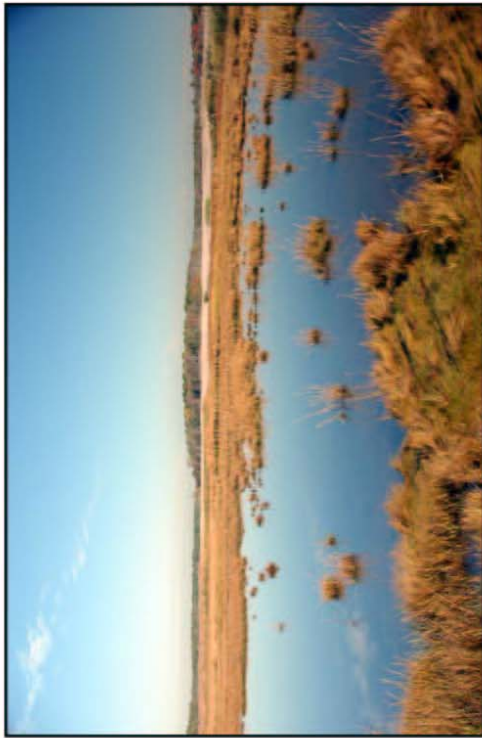


2008 Area 2 Pt. 5 S

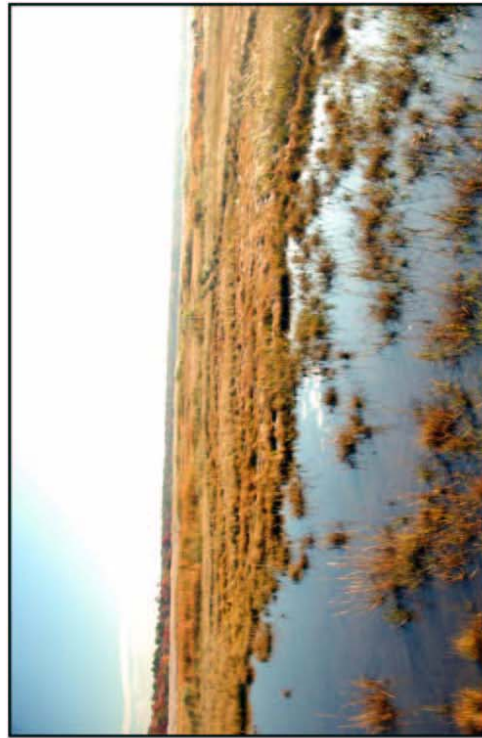


2008 Area 2 Pt. 5 W

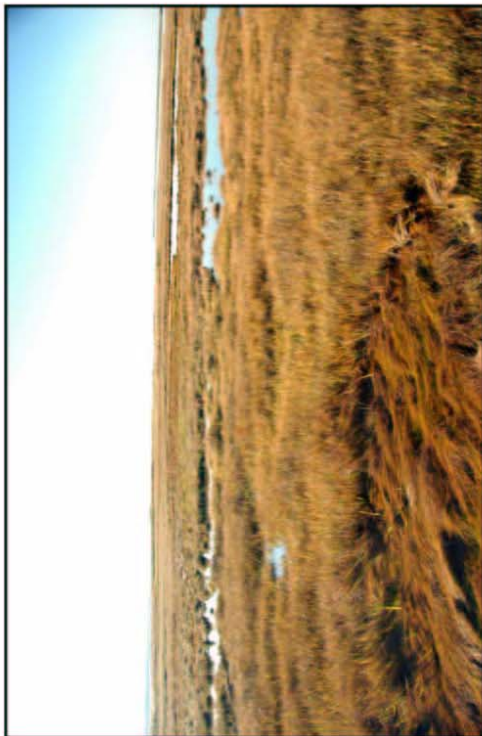




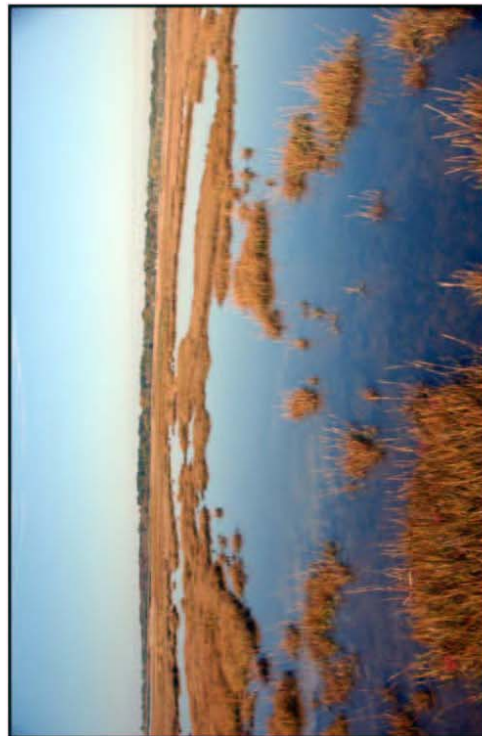
2008 Area 2 Pt. 6 N



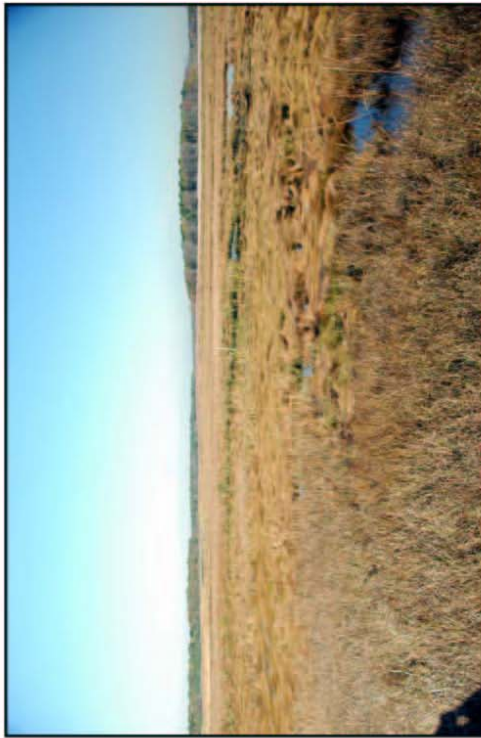
2008 Area 2 Pt. 6 E



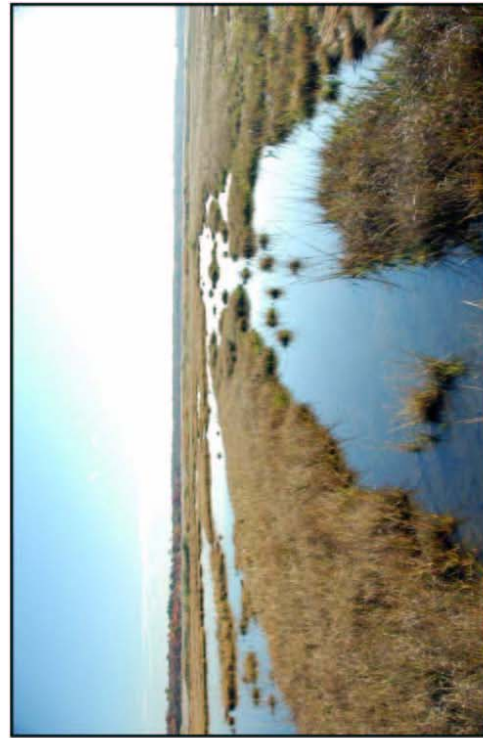
2008 Area 2 Pt. 6 S



2008 Area 2 Pt. 6 W



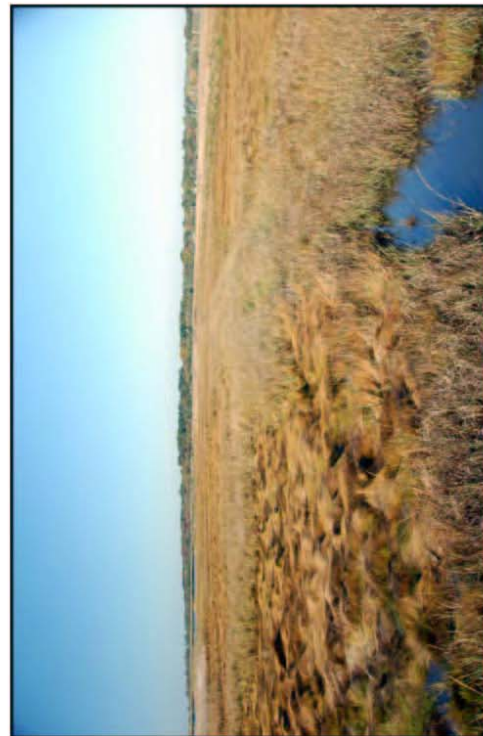
2008 Area 2 Pt. 7 N



2008 Area 2 Pt. 7 E



2008 Area 2 Pt. 7 S

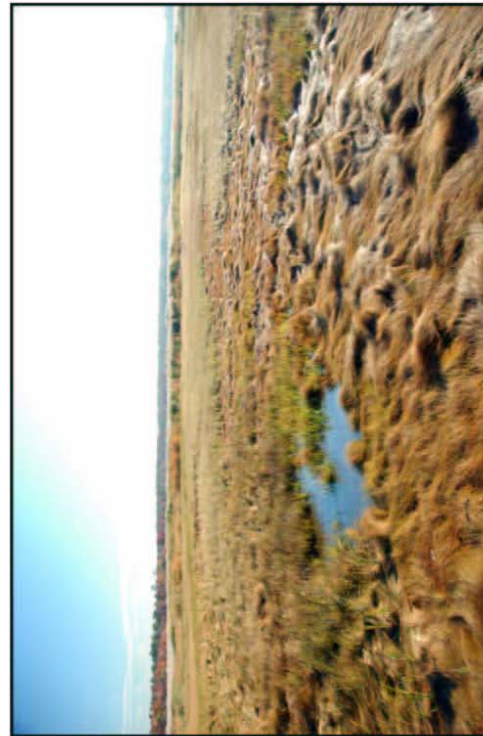


2008 Area 2 Pt. 7 W





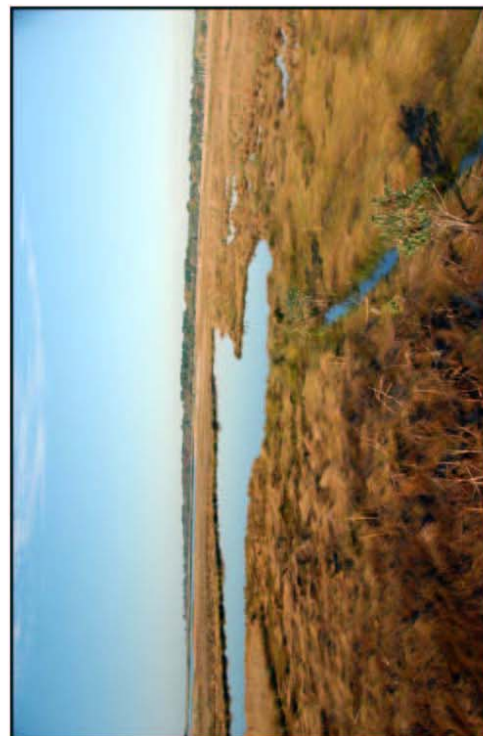
2008 Area 2 Pt. 8 N



2008 Area 2 Pt. 8 E



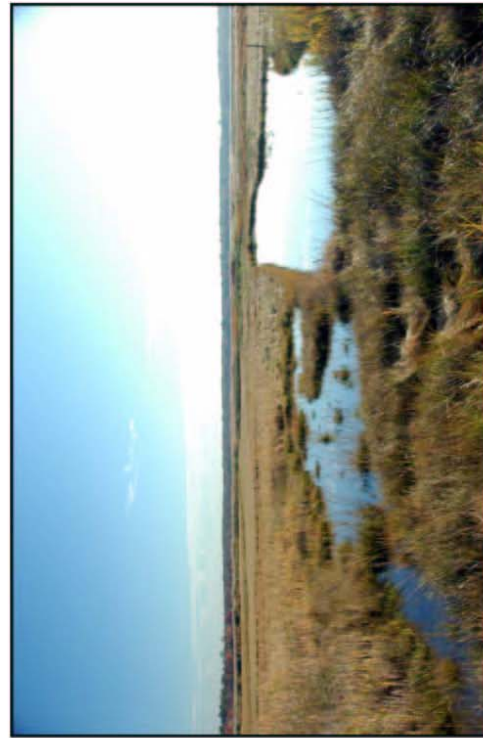
2008 Area 2 Pt. 8 S



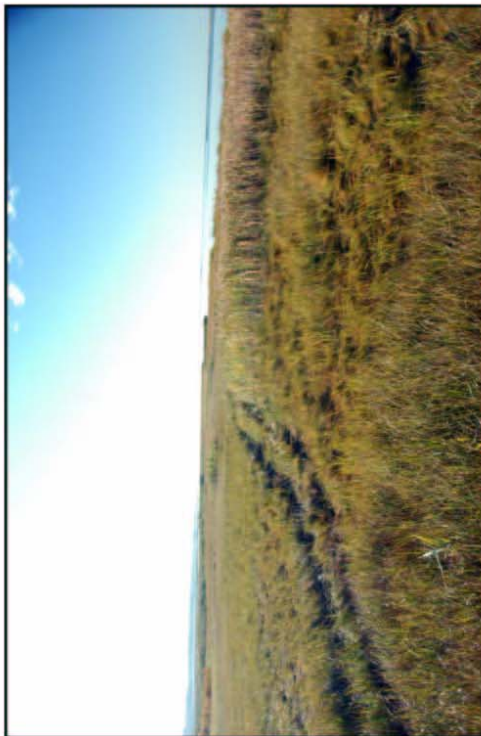
2008 Area 2 Pt. 8 W



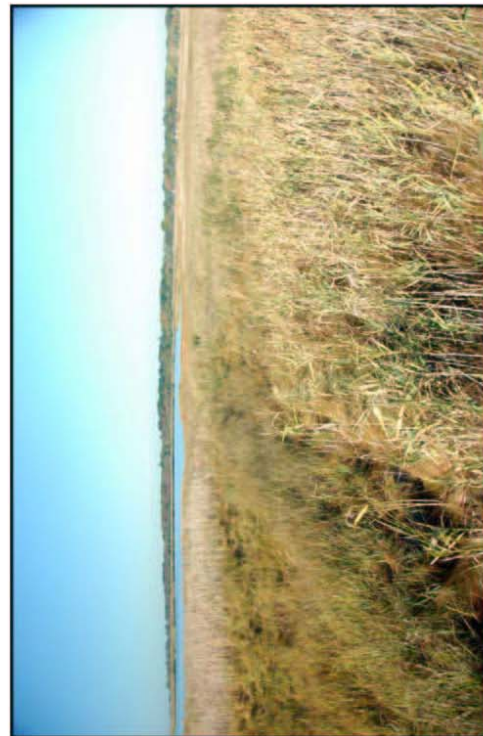
2008 Area 2 Pt. 9 N



2008 Area 2 Pt. 9 E



2008 Area 2 Pt. 9 S



2008 Area 2 Pt. 9 W





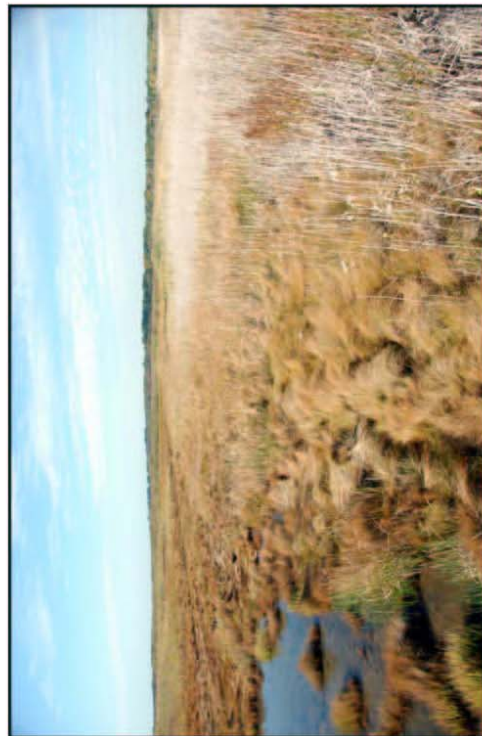
2008 Area 3 Pt. 1 N



2008 Area 3 Pt. 1 E



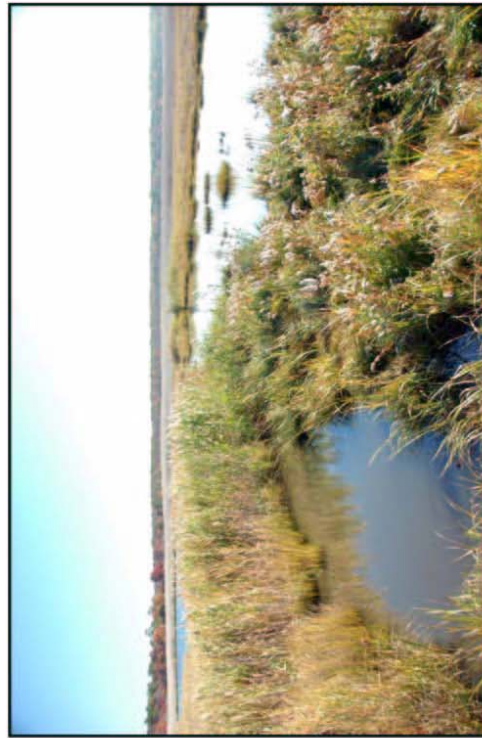
2008 Area 3 Pt. 1 S



2008 Area 3 Pt. 1 W



2008 Area 3 Pt. 2 N



2008 Area 3 Pt. 2 E



2008 Area 3 Pt. 2 S



2008 Area 3 Pt. 2 W

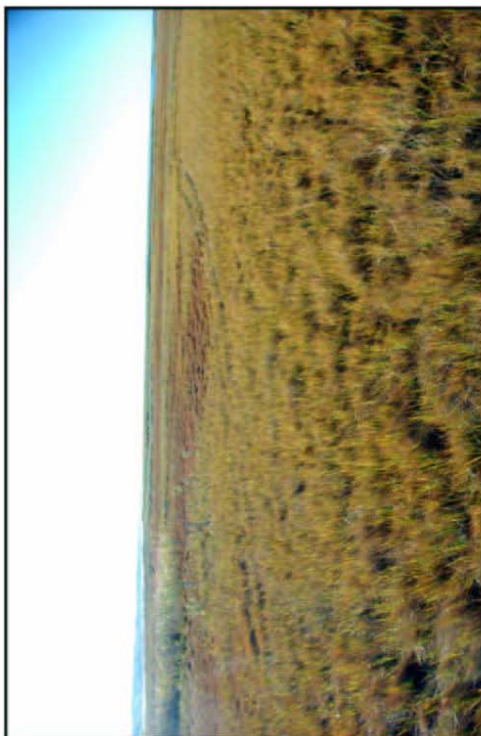




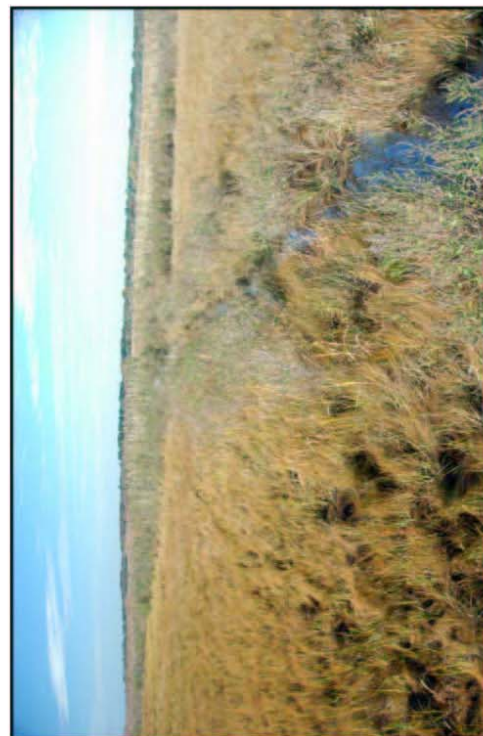
2008 Area 3 Pt. 3 N



2008 Area 3 Pt. 3 E



2008 Area 3 Pt. 3 S



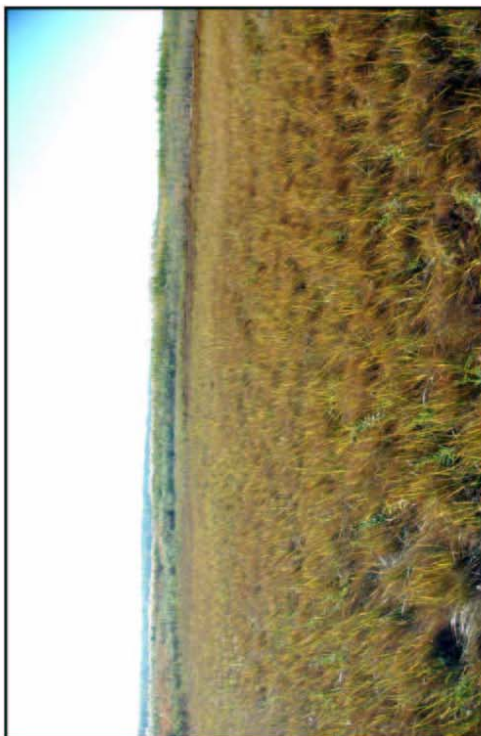
2008 Area 3 Pt. 3 W



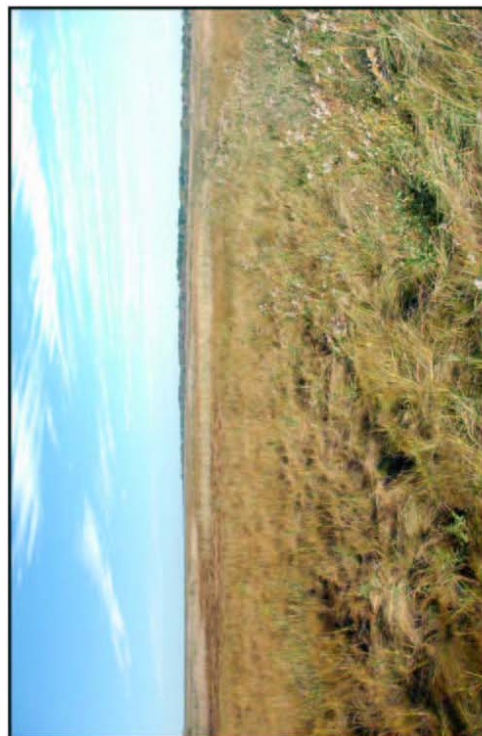
2008 Area 3 Pt. 4 N



2008 Area 3 Pt. 4 E



2008 Area 3 Pt. 4 S

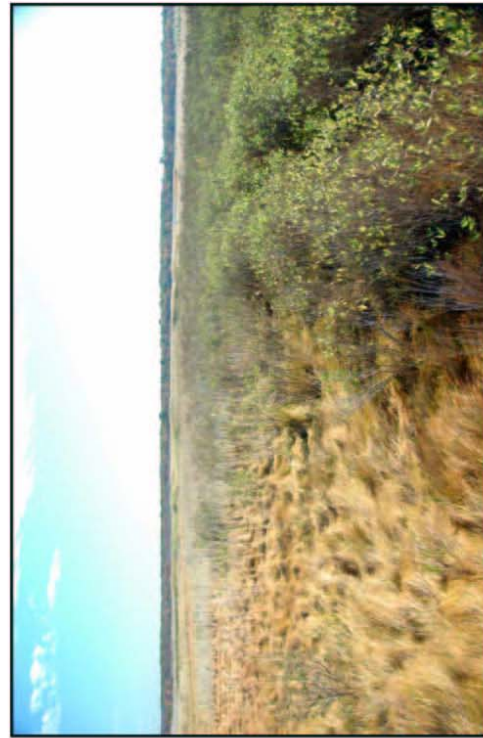


2008 Area 3 Pt. 4 W





2008 Area 3 Pt. 5 N



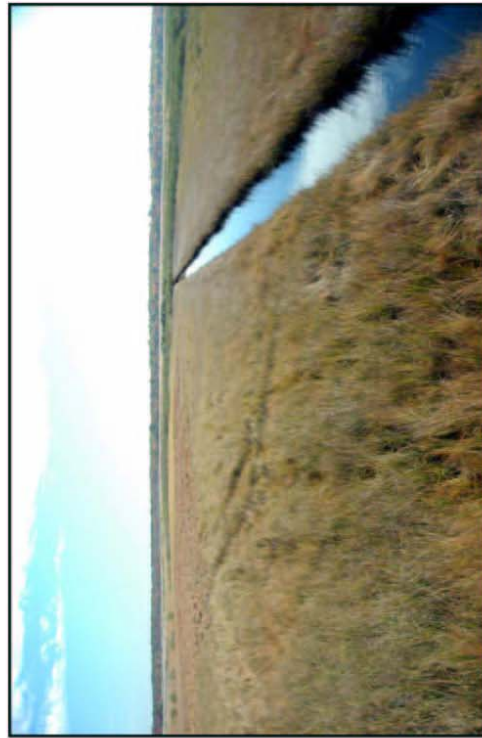
2008 Area 3 Pt. 5 E



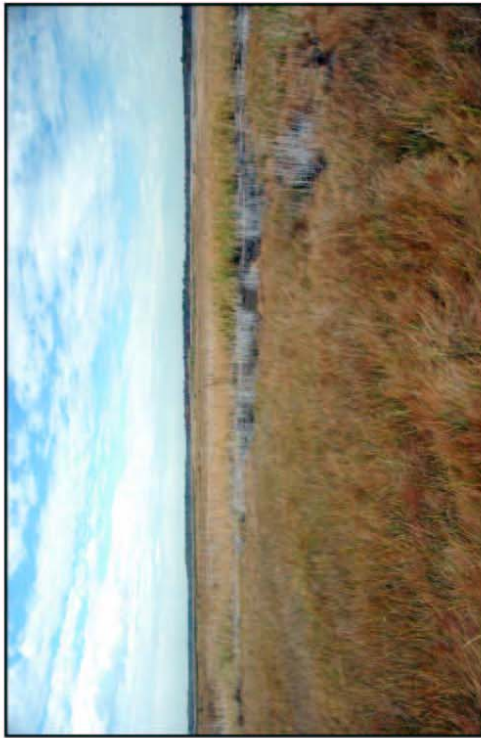
2008 Area 3 Pt. 5 S



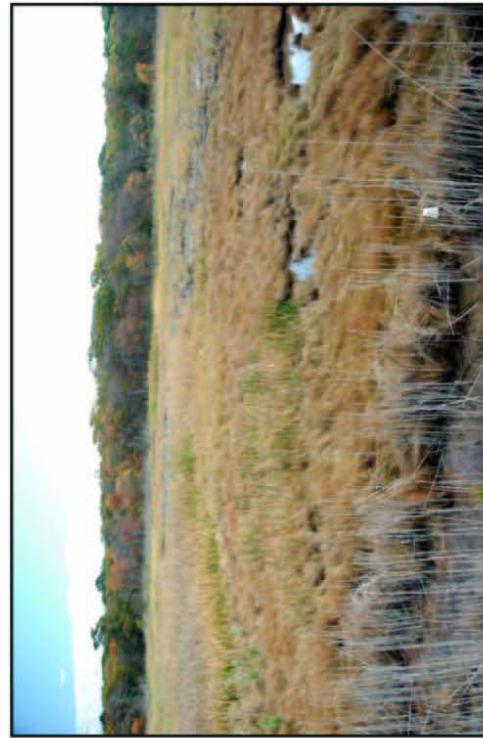
2008 Area 3 Pt. 5 W



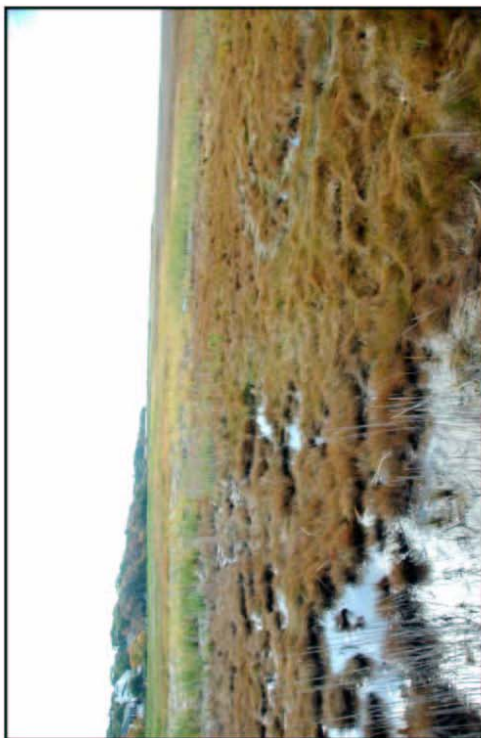




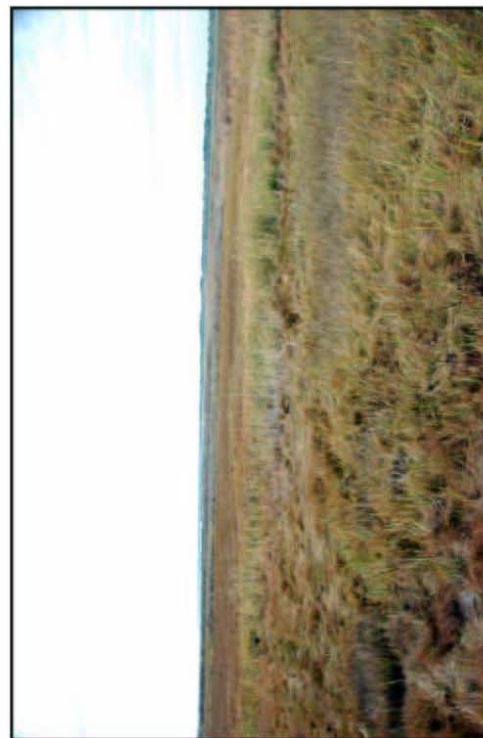
2008 Area 4 Pt. 1 N



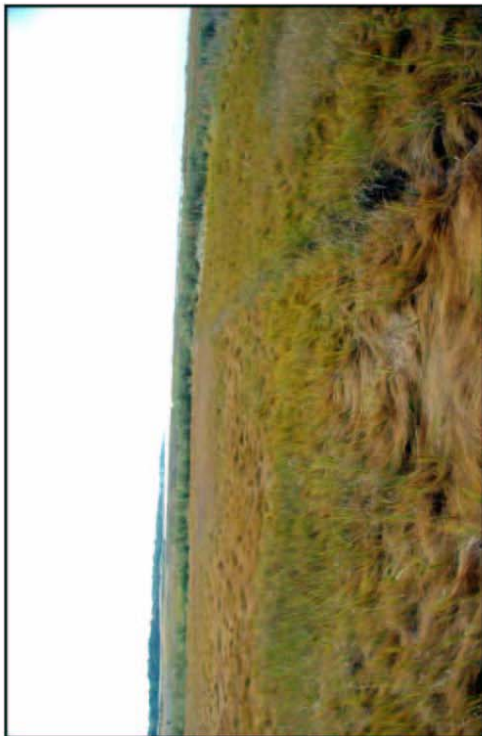
2008 Area 4 Pt. 1 E



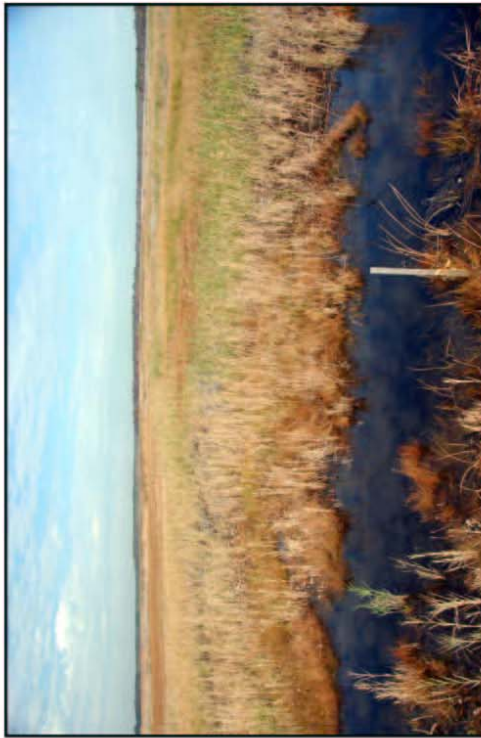
2008 Area 4 Pt. 1 S



2008 Area 4 Pt. 1 W



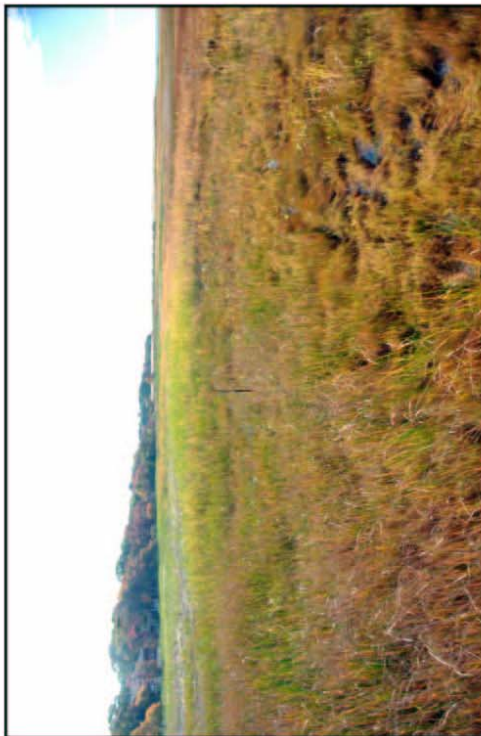




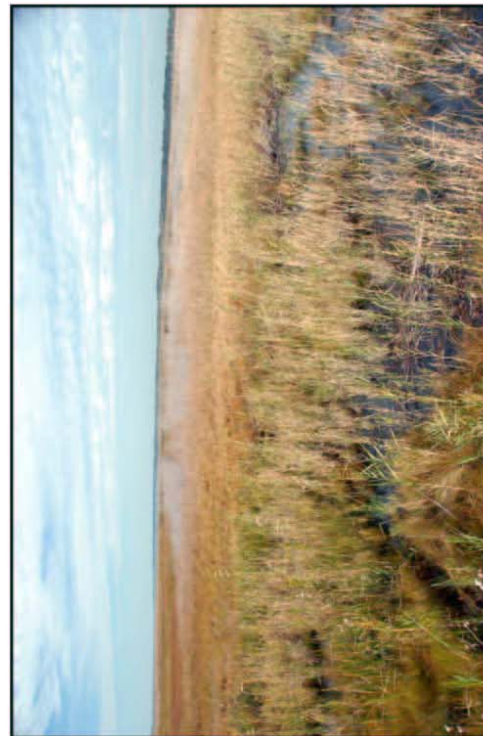
2008 Area 4 Pt. 3 N



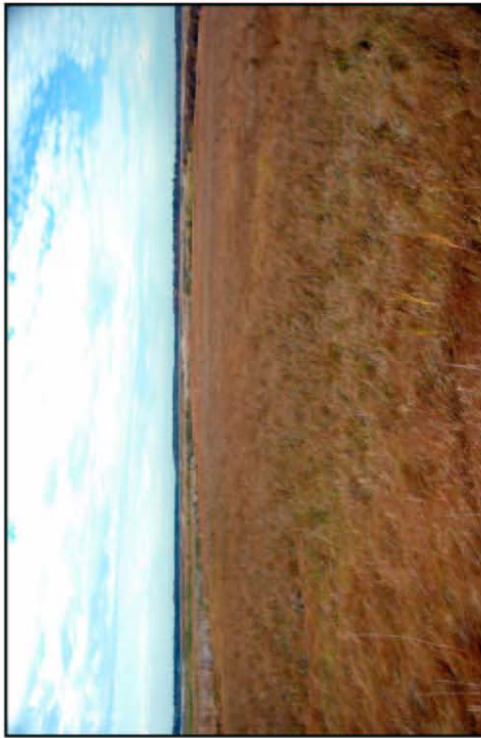
2008 Area 4 Pt. 3 E



2008 Area 4 Pt. 3 S



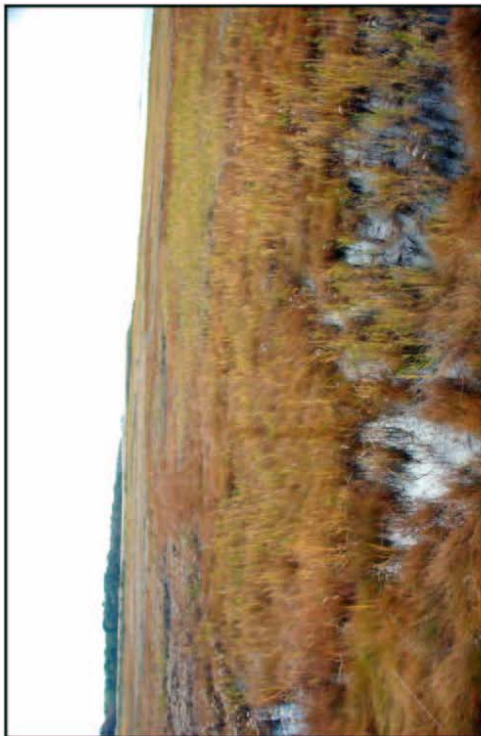
2008 Area 4 Pt. 3 W



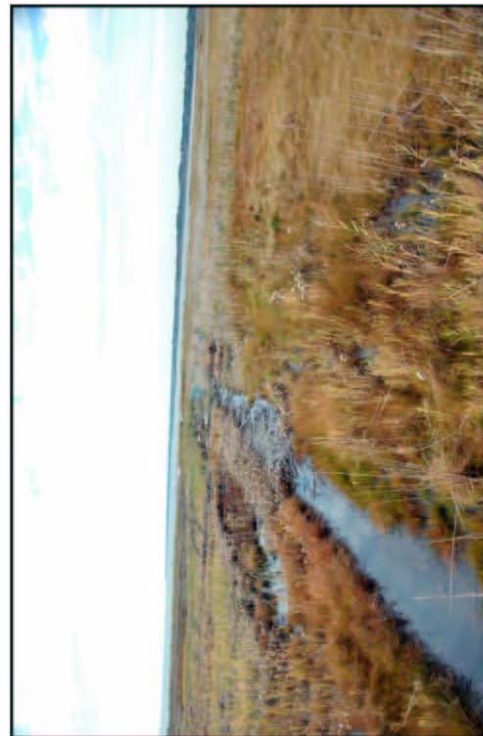
2008 Area 4 Pt. 4 N



2008 Area 4 Pt. 4 E



2008 Area 4 Pt. 4 S



2008 Area 4 Pt. 4 W





2008 Area 4 Pt. 5 N



2008 Area 4 Pt. 5 E



2008 Area 4 Pt. 5 S



2008 Area 4 Pt. 5 W

## **Appendix E**

### **Mosquito Larvae 2008**





**Wertheim NWR Water Management Demonstration Project Data Report**  
**Mosquito Larvae**  
**2008**

Area	Date	Station #	Condition	Total # Larvae	Comments
1	5/5/2008	Targeted	Dry	0	ref
1	5/5/2008	Targeted	Dry No Water	0	
1	5/5/2008	Targeted	Flooded	0	
1	5/5/2008	Targeted	Flooded Areas	0	
1	5/5/2008	Targeted	Flooded Areas	0	
1	5/5/2008	Targeted	Flooded Areas	0	
1	5/5/2008	Targeted	Flooded Areas	0	
1	5/5/2008	Targeted	Flooded Areas	0	
1	5/5/2008	Targeted	Flooded Areas	0	
1	5/5/2008	Targeted	Panne	0	
1	5/5/2008	Targeted	Panne	0	
1	5/5/2008	Targeted	Panne	0	
1	5/5/2008	Targeted	Pooled Holes	0	
1	5/5/2008	Targeted	Pooled Holes	0	
1	5/5/2008	Targeted	Pooled Holes	0	
1	5/5/2008	Targeted	Pooled Holes	0	
1	5/5/2008	Targeted	Pooled Holes	0	
1	5/5/2008	Targeted	Pooled Holes	0	A lot of H2O
1	5/5/2008	Targeted	Pooled Holes	0	
1	5/5/2008	Targeted	Pooled Holes	0	
1	5/5/2008	Targeted	Pooled Holes	0	High Tide
1	5/5/2008	Targeted	Pooled Holes	0	
1	5/5/2008	Targeted	Saturated Soil	0	
1	5/14/2008	1--1-- 60	Flooded Areas	0	
1	5/14/2008	1--1-- 40	Flooded Areas	0	
1	5/14/2008	1--1-- 20	Flooded Areas	0	
1	5/14/2008	1--1-- 0	Flooded Areas	0	
1	5/14/2008	1--1--100	Pooled Holes	0	
1	5/14/2008	1--1--120	Pooled Holes	0	
1	5/14/2008	1--1-- 80	Pooled Holes	0	
1	5/14/2008	1--2-- 60	Flooded Areas	0	
1	5/14/2008	1--2-- 80	Flooded Areas	0	no marker
1	5/14/2008	1--2-- 100	Flooded Areas	0	
1	5/14/2008	1--2--120	Flooded Areas	0	
1	5/14/2008	1--2-- 40	Flooded Areas	0	
1	5/14/2008	1--2-- 20	Flooded Areas	0	
1	5/14/2008	1--2-- 0	Pooled Holes	0	
1	5/14/2008	1--3-- 0	Flooded Areas	0	
1	5/14/2008	1--3-- 60	Flooded Areas	0	
1	5/14/2008	1--3-- 180	Flooded Areas	0	
1	5/14/2008	1--3--140	Flooded Areas	0	
1	5/14/2008	1--3--120	Flooded Areas	0	
1	5/14/2008	1--3-- 100	Flooded Areas	0	
1	5/14/2008	1--3--160	Flooded Areas	0	no marker
1	5/14/2008	1--3--200	Flooded Areas	0	
1	5/14/2008	1--3-- 80	Flooded Areas	0	
1	5/14/2008	1--3-- 20	Flooded Areas	0	
1	5/14/2008	1--3-- 40	Flooded Areas	0	
1	5/14/2008	1--4--100	Flooded	0	
1	5/14/2008	1--4--220	Flooded	0	
1	5/14/2008	1--4--240	Flooded	0	
1	5/14/2008	1--4-- 0	Flooded Areas	0	
1	5/14/2008	1--4-- 20	Standing Water	0	ref
1	5/14/2008	1--4-- 40		0	BIRD 1
1	5/14/2008	1--4-- 60		0	BIRD 2
1	5/14/2008	1--4-- 80		0	BIRD 3
1	5/14/2008	1--4--120		0	Unknown stake short
1	5/14/2008	1--4-- 140		0	BIRD 5
1	5/14/2008	1--4--160		0	BIRD 5 check this 1
1	5/14/2008	1--4--180		0	BIRD 1 Tape Twice
1	5/14/2008	1--4--200		0	BIRD 3

[illegible]

Area	Date	Station #	Condition	Total # Larvae	Comments
1	5/27/2008	Targeted	Pooled Holes	0	
1	5/27/2008	Targeted	Pooled Holes	0	
1	5/27/2008	Targeted	Pooled Holes	0	
1	5/29/2008	Targeted	Dry No Water	0	
1	6/2/2008	Targeted	Dry No Water	0	
1	6/2/2008	Targeted	Flooded Areas	0	
1	6/2/2008	Targeted	Panne	0	
1	6/2/2008	Targeted	Panne	0	
1	6/2/2008	Targeted	Panne	0	
1	6/2/2008	Targeted	Panne	0	
1	6/2/2008	Targeted	Pooled Holes	0	
1	6/2/2008	Targeted	Pooled Holes	0	
1	6/2/2008	Targeted	Pooled Holes	0	
1	6/2/2008	Targeted	Pooled Holes	0	
1	6/2/2008	Targeted	Pooled Holes	0	
1	6/2/2008	Targeted	Pooled Holes	0	
1	6/2/2008	Targeted	Pooled Holes	0	
1	6/2/2008	Targeted	Pooled Holes	0	
1	6/2/2008	Targeted	Pooled Holes	0	
1	6/2/2008	Targeted	Pooled Holes	0	
1	6/2/2008	Targeted	Pooled Holes	0	
1	6/2/2008	Targeted	Pooled Holes	0	
1	6/2/2008	Targeted	Pooled Holes	0	
1	6/2/2008	Targeted	Pooled Holes	0	
1	6/2/2008	Targeted	Pooled Holes	0	
1	6/2/2008	Targeted	Pooled Holes	0	
1	6/2/2008	Targeted	Pooled Holes	0	
1	6/2/2008	Targeted	Pooled Holes	0	
1	6/2/2008	Targeted	Pooled Holes	0	
1	6/10/2008	1--1-- 120	Dry No Water	0	
1	6/10/2008	1--1-- 100	Dry No Water	0	
1	6/10/2008	1--1-- 80	Dry No Water	0	
1	6/10/2008	1--1-- 0	Dry No Water	0	
1	6/10/2008	1--1-- 20	Dry No Water	0	
1	6/10/2008	1--1-- 40	Pond	0	
1	6/10/2008	1--1-- 60	Pooled Holes	0	fish
1	6/10/2008	1--2-- 20	Dry No Water	0	
1	6/10/2008	1--2-- 0	Dry No Water	0	
1	6/10/2008	1--2-- 120	Dry No Water	0	
1	6/10/2008	1--2-- 100	Dry No Water	0	
1	6/10/2008	1--2-- 80	Dry No Water	0	no stake
1	6/10/2008	1--2-- 40	Dry No Water	0	
1	6/10/2008	1--2-- 60	Dry No Water	0	
1	6/10/2008	1--3-- 0	Dry No Water	0	
1	6/10/2008	1--3-- 20	Dry No Water	0	
1	6/10/2008	1--3-- 40	Dry No Water	0	
1	6/10/2008	1--3-- 60	Dry No Water	0	
1	6/10/2008	1--3-- 80	Dry No Water	0	
1	6/10/2008	1--3-- 100	Dry No Water	0	
1	6/10/2008	1--3-- 120	Dry No Water	0	
1	6/10/2008	1--3-- 140	Dry No Water	0	
1	6/10/2008	1--3-- 180	Dry No Water	0	
1	6/10/2008	1--3-- 200	Dry No Water	0	
1	6/10/2008	1--3-- 160	Dry No Water	0	
1	6/10/2008	1--4-- 240	Dry No Water	0	
1	6/10/2008	1--4-- 180	Dry No Water	0	
1	6/10/2008	1--4-- 220	Dry No Water	0	
1	6/10/2008	1--4-- 80	Dry No Water	0	
1	6/10/2008	1--4-- 100	Dry No Water	0	
1	6/10/2008	1--4-- 40	Dry No Water	0	
1	6/10/2008	1--4-- 20	Dry No Water	0	
1	6/10/2008	1--4-- 160	Dry No Water	0	
1	6/10/2008	1--4-- 140	Dry No Water	0	
1	6/10/2008	1--4-- 200	Dry No Water	0	
1	6/10/2008	1--4-- 120	Dry No Water	0	

**Wertheim NWR Water Management Demonstration Project Data Report**  
**Mosquito Larvae**  
**2008**

Area	Date	Station #	Condition	Total # Larvae	Comments
1	6/10/2008	1-4-- 0	Panne	0	
1	6/10/2008	1-4-- 60	Panne	0	
1	6/10/2008	1-5-- 20	Dry No Water	0	
1	6/10/2008	1-5-- 80	Dry No Water	0	
1	6/10/2008	1-5-- 0	Dry No Water	0	
1	6/10/2008	1-5-- 60	Saturated Soil	0	
1	6/10/2008	1-5-- 40	Saturated Soil	0	
1	6/10/2008	Targeted	Dry No Water	0	
1	6/10/2008	Targeted	Dry No Water	0	
1	6/10/2008	Targeted	Panne	0	
1	6/10/2008	Targeted	Panne	0	
1	6/10/2008	Targeted	Panne	0	
1	6/10/2008	Targeted	Panne	0	
1	6/10/2008	Targeted	Pooled Holes	0	
1	6/10/2008	Targeted	Pooled Holes	0	
1	6/10/2008	Targeted	Pooled Holes	0	
1	6/10/2008	Targeted	Pooled Holes	0	duck
1	6/10/2008	Targeted	Pooled Holes	0	
1	6/16/2008	Targeted	Dry No Water	0	
1	6/16/2008	Targeted	Dry No Water	0	
1	6/16/2008	Targeted	Dry No Water	0	
1	6/16/2008	Targeted	Dry No Water	0	
1	6/16/2008	Targeted	Dry No Water	0	
1	6/16/2008	Targeted	Dry No Water	0	
1	6/16/2008	Targeted	Dry No Water	0	
1	6/16/2008	Targeted	Dry No Water	0	
1	6/16/2008	Targeted	Panne	0	
1	6/16/2008	Targeted	Panne	0	
1	6/16/2008	Targeted	Panne	0	
1	6/16/2008	Targeted	Panne	0	
1	6/16/2008	Targeted	Panne	0	very little H2O
1	6/16/2008	Targeted	Panne	0	
1	6/16/2008	Targeted	Pooled Holes	0	
1	6/16/2008	Targeted	Pooled Holes	0	
1	6/16/2008	Targeted	Pooled Holes	0	
1	6/16/2008	Targeted	Pooled Holes	0	
1	6/16/2008	Targeted	Pooled Holes	0	
1	6/16/2008	Targeted	Pooled Holes	0	
1	6/16/2008	Targeted	Pooled Holes	0	
1	6/16/2008	Targeted	Pooled Holes	0	
1	6/16/2008	Targeted	Pooled Holes	0	
1	6/16/2008	Targeted	Pooled Holes	0	
1	6/16/2008	Targeted	Pooled Holes	0	
1	6/23/2008	Targeted	Dry No Water	0	
1	6/23/2008	Targeted	Dry No Water	0	
1	6/23/2008	Targeted	Dry No Water	0	
1	6/23/2008	Targeted	Panne	11	
1	6/23/2008	Targeted	Panne	5	
1	6/23/2008	Targeted	Panne	5	
1	6/23/2008	Targeted	Panne	2	
1	6/23/2008	Targeted	Panne	2	
1	6/23/2008	Targeted	Panne	1	drying upLast Fri more
1	6/23/2008	Targeted	Panne	1	
1	6/23/2008	Targeted	Panne	1	
1	6/23/2008	Targeted	Panne	0	
1	6/23/2008	Targeted	Panne	0	
1	6/23/2008	Targeted	Panne	0	
1	6/23/2008	Targeted	Panne	0	
1	6/23/2008	Targeted	Panne	0	
1	6/23/2008	Targeted	Panne	0	fish
1	6/23/2008	Targeted	Panne	0	
1	6/23/2008	Targeted	Panne	0	
1	6/23/2008	Targeted	Panne	0	
1	6/23/2008	Targeted	Panne	0	
1	6/23/2008	Targeted	Pooled Holes	2	
1	6/23/2008	Targeted	Pooled Holes	2	

[illegible]



[illegible]

[illegible]

**Wertheim NWR Water Management Demonstration Project Data Report**  
**Mosquito Larvae**  
**2008**

Area	Date	Station #	Condition	Total # Larvae	Comments
1	7/28/2008	Targeted	Pooled Holes	0	
1	7/28/2008	Targeted	Pooled Holes	0	
1	7/28/2008	Targeted	Pooled Holes	0	
1	7/28/2008	Targeted	Pooled Holes	0	
1	7/28/2008	Targeted	Saturated Soil	0	
1	8/5/2008	1--1--100	Dry No Water	0	
1	8/5/2008	1--1--120	Dry No Water	0	
1	8/5/2008	1--1--80	Dry No Water	0	
1	8/5/2008	1--1--0	Dry No Water	0	
1	8/5/2008	1--1--20	Dry No Water	0	
1	8/5/2008	1--1--40	Pond	0	
1	8/5/2008	1--1--60	Pooled Holes	0	
1	8/5/2008	1--2--20	Dry No Water	0	
1	8/5/2008	1--2--100	Dry No Water	0	
1	8/5/2008	1--2--0	Dry No Water	0	
1	8/5/2008	1--2--60	Dry No Water	0	
1	8/5/2008	1--2--80	Dry No Water	0	
1	8/5/2008	1--2--40	Dry No Water	0	
1	8/5/2008	1--2--120	Panne	0	
1	8/5/2008	1--3--80	Dry No Water	0	
1	8/5/2008	1--3--100	Dry No Water	0	
1	8/5/2008	1--3--160	Dry No Water	0	
1	8/5/2008	1--3--180	Dry No Water	0	
1	8/5/2008	1--3--200	Dry No Water	0	
1	8/5/2008	1--3--140	Dry No Water	0	
1	8/5/2008	1--3--120	Dry No Water	0	
1	8/5/2008	1--3--40	Dry No Water	0	
1	8/5/2008	1--3--0	Dry No Water	0	
1	8/5/2008	1--3--20	Dry No Water	0	
1	8/5/2008	1--3--60	Pooled Holes	0	
1	8/5/2008	1--4--20	Dry No Water	0	
1	8/5/2008	1--4--40	Dry No Water	0	
1	8/5/2008	1--4--0	Dry No Water	0	
1	8/5/2008	1--4--100	Panne	0	very little H2O
1	8/5/2008	1--4--60	Panne	0	
1	8/5/2008	1--4--200	Pooled Holes	0	very little H2O
1	8/5/2008	1--4--220	Saturated Soil	0	
1	8/5/2008	1--4--120	Saturated Soil	0	
1	8/5/2008	1--4--180	Saturated Soil	0	
1	8/5/2008	1--4--140	Saturated Soil	0	
1	8/5/2008	1--4--240	Saturated Soil	0	
1	8/5/2008	1--4--160	Saturated Soil	0	
1	8/5/2008	1--4--80	Saturated Soil	0	
1	8/5/2008	1--5--60	Panne	0	
1	8/5/2008	1--5--20	Panne	0	
1	8/5/2008	1--5--40	Pooled Holes	0	
1	8/5/2008	1--5--80	Saturated Soil	0	
1	8/5/2008	1--5--0	Saturated Soil	0	
1	8/5/2008	Targeted	Panne	0	
1	8/5/2008	Targeted	Panne	0	
1	8/5/2008	Targeted	Panne	0	
1	8/5/2008	Targeted	Panne	0	
1	8/5/2008	Targeted	Panne	0	fish
1	8/5/2008	Targeted	Pooled Holes	0	
1	8/5/2008	Targeted	Pooled Holes	0	
1	8/5/2008	Targeted	Pooled Holes	0	
1	8/5/2008	Targeted	Pooled Holes	0	
1	8/5/2008	Targeted	Pooled Holes	0	
1	8/5/2008	Targeted	Pooled Holes	0	usually more H2O
1	8/5/2008	Targeted	Pooled Holes	0	
1	8/5/2008	Targeted	Pooled Holes	0	
1	8/5/2008	Targeted	Pooled Holes	0	
1	8/11/2008	Targeted	Dry No Water	0	
1	8/11/2008	Targeted	Dry No Water	0	
1	8/11/2008	Targeted	Dry No Water	0	

[illegible]

Area	Date	Station #	Condition	Total # Larvae	Comments
1	8/18/2008	Targeted	Pooled Holes	0	
1	8/18/2008	Targeted	Pooled Holes	0	
1	8/18/2008	Targeted	Pooled Holes	0	
1	8/18/2008	Targeted	Pooled Holes	0	
1	8/18/2008	Targeted	Pooled Holes	0	
1	8/18/2008	Targeted	Pooled Holes	0	
1	8/18/2008	Targeted	Pooled Holes	0	
1	8/18/2008	Targeted	Saturated Soil	0	
1	8/25/2008	Targeted	Dry No Water	0	
1	8/25/2008	Targeted	Dry No Water	0	
1	8/25/2008	Targeted	Dry No Water	0	
1	8/25/2008	Targeted	Dry No Water	0	
1	8/25/2008	Targeted	Dry No Water	0	
1	8/25/2008	Targeted	Dry No Water	0	
1	8/25/2008	Targeted	Dry No Water	0	
1	8/25/2008	Targeted	Dry No Water	0	
1	8/25/2008	Targeted	Dry No Water	0	
1	8/25/2008	Targeted	Dry No Water	0	
1	8/25/2008	Targeted	Dry No Water	0	
1	8/25/2008	Targeted	Dry No Water	0	
1	8/25/2008	Targeted	Dry No Water	0	
1	8/25/2008	Targeted	Dry No Water	0	
1	8/25/2008	Targeted	Dry No Water	0	
1	8/25/2008	Targeted	Dry No Water	0	
1	8/25/2008	Targeted	Dry No Water	0	
1	8/25/2008	Targeted	Dry No Water	0	
1	8/25/2008	Targeted	Dry No Water	0	
1	8/25/2008	Targeted	Dry No Water	0	
1	8/25/2008	Targeted	Dry No Water	0	
1	8/25/2008	Targeted	Dry No Water	0	
1	8/25/2008	Targeted	Dry No Water	0	
1	8/25/2008	Targeted	Flooded Areas	0	
1	8/25/2008	Targeted	Pooled Holes	0	
1	9/3/2008	Targeted	Dry No Water	0	
1	9/3/2008	Targeted	Dry No Water	0	
1	9/3/2008	Targeted	Dry No Water	0	
1	9/3/2008	Targeted	Dry No Water	0	
1	9/3/2008	Targeted	Dry No Water	0	
1	9/3/2008	Targeted	Panne	25	
1	9/3/2008	Targeted	Panne	3	
1	9/3/2008	Targeted	Panne	1	
1	9/3/2008	Targeted	Panne	0	
1	9/3/2008	Targeted	Panne	0	
1	9/3/2008	Targeted	Panne	0	
1	9/3/2008	Targeted	Panne	0	
1	9/3/2008	Targeted	Panne	0	
1	9/3/2008	Targeted	Pooled Holes	15	little H 2O
1	9/3/2008	Targeted	Pooled Holes	1	
1	9/3/2008	Targeted	Pooled Holes	0	
1	9/3/2008	Targeted	Pooled Holes	0	
1	9/3/2008	Targeted	Pooled Holes	0	
1	9/3/2008	Targeted	Pooled Holes	0	
1	9/3/2008	Targeted	Pooled Holes	0	
1	9/3/2008	Targeted	Pooled Holes	0	
1	9/3/2008	Targeted	Pooled Holes	0	
1	9/3/2008	Targeted	Pooled Holes	0	
1	9/3/2008	Targeted	Pooled Holes	0	
1	9/3/2008	Targeted	Pooled Holes	0	
1	9/3/2008	Targeted	Pooled Holes	0	
1	9/3/2008	Targeted	Pooled Holes	0	
1	9/3/2008	Targeted	Saturated Soil	0	
1	9/8/2008	Targeted	Panne	0	
1	9/10/2008	1--1-- 20	Dry No Water	0	



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**Wertheim NWR Water Management Demonstration Project Data Report**  
**Mosquito Larvae**  
**2008**

Area	Date	Station #	Condition	Total # Larvae	Comments
1	9/17/2008	Targeted	Pooled Holes	0	
1	9/17/2008	Targeted	Pooled Holes	0	
1	9/17/2008	Targeted	Pooled Holes	0	
1	9/17/2008	Targeted	Pooled Holes	0	
1	9/17/2008	Targeted	Pooled Holes	0	
1	9/17/2008	Targeted	Pooled Holes	0	
1	9/17/2008	Targeted	Pooled Holes	0	
1	9/17/2008	Targeted	Pooled Holes	0	
2	5/5/2008	Targeted	Flooded	0	
2	5/5/2008	Targeted	Flooded Areas	0	
2	5/5/2008	Targeted	Flooded Areas	0	
2	5/5/2008	Targeted	Flooded Areas	0	
2	5/5/2008	Targeted	Flooded Areas	0	
2	5/5/2008	Targeted	Flooded Areas	0	
2	5/5/2008	Targeted	Flooded Areas	0	
2	5/5/2008	Targeted	Flooded Areas	0	
2	5/5/2008	Targeted	Flooded Areas	0	
2	5/5/2008	Targeted	Flooded Areas	0	
2	5/5/2008	Targeted	Flooded Areas	0	
2	5/5/2008	Targeted	Flooded Areas	0	
2	5/5/2008	Targeted	Flooded Areas	0	
2	5/5/2008	Targeted	Flooded Areas	0	
2	5/5/2008	Targeted	Flooded Areas	0	
2	5/5/2008	Targeted	Flooded Areas	0	
2	5/5/2008	Targeted	Flooded Areas	0	
2	5/5/2008	Targeted	Flooded Areas	0	
2	5/5/2008	Targeted	Flooded Areas	0	
2	5/5/2008	Targeted	Panne	0	
2	5/5/2008	Targeted	Pooled Holes	0	
2	5/5/2008	Targeted	Pooled Holes	0	
2	5/5/2008	Targeted	Pooled Holes	0	
2	5/5/2008	Targeted	Pooled Holes	0	
2	5/5/2008	Targeted	Pooled Holes	0	
2	5/5/2008	Targeted	Pooled Holes	0	
2	5/14/2008	Targeted	Flooded	0	
2	5/15/2008	2--1-- 120	Flooded Areas	0	
2	5/15/2008	2--1-- 20	Flooded Areas	0	
2	5/15/2008	2--1-- 60	Flooded Areas	0	
2	5/15/2008	2--1-- 80	Flooded Areas	0	
2	5/15/2008	2--1-- 100	Flooded Areas	0	
2	5/15/2008	2--1-- 160	Flooded Areas	0	
2	5/15/2008	2--1-- 40	Flooded Areas	0	
2	5/15/2008	2--1-- 140	Flooded Areas	0	H2O off pond
2	5/15/2008	2--1-- 0	Pooled Holes	0	
2	5/15/2008	2--2--200	Ditch	0	
2	5/15/2008	2--2-- 40	Ditch	0	
2	5/15/2008	2--2--180	Dry No Water	0	
2	5/15/2008	2--2-- 0	Dry No Water	0	
2	5/15/2008	2--2-- 100	Flooded Areas	0	
2	5/15/2008	2--2-- 80	Flooded Areas	0	H2O everywhere
2	5/15/2008	2--2-- 120	Flooded Areas	0	
2	5/15/2008	2--2-- 20	Pond	0	
2	5/15/2008	2--2-- 140	Pooled Holes	0	
2	5/15/2008	2--2--160	Pooled Holes	0	
2	5/15/2008	2--2-- 60	Pooled Holes	0	
2	5/15/2008	2--3-- 40	Flooded Areas	0	
2	5/15/2008	2--3-- 60	Flooded Areas	0	
2	5/15/2008	2--3-- 120	Flooded Areas	0	
2	5/15/2008	2--3-- 100	Flooded Areas	0	
2	5/15/2008	2--3-- 80	Flooded Areas	0	
2	5/15/2008	2--3-- 0	Flooded Areas	0	
2	5/15/2008	2--3-- 20	Flooded Areas	0	
2	5/15/2008	2--3--200	Panne	0	
2	5/15/2008	2--3-- 180	Panne	0	
2	5/15/2008	2--3--160	Panne	0	

**Wertheim NWR Water Management Demonstration Project Data Report**  
**Mosquito Larvae**  
**2008**

Area	Date	Station #	Condition	Total # Larvae	Comments
2	5/15/2008	2--3--140	Panne	0	
2	5/15/2008	2--4-- 120	Dry No Water	0	
2	5/15/2008	2--4-- 0	Panne	0	
2	5/15/2008	2--4-- 20	Panne	0	
2	5/15/2008	2--4-- 40	Panne	0	
2	5/15/2008	2--4-- 60	Panne	0	
2	5/15/2008	2--4-- 80	Panne	0	
2	5/15/2008	2--4--100	Panne	0	
2	5/15/2008	2--5-- 80	Dry No Water	0	
2	5/15/2008	2--5-- 60	Dry No Water	0	
2	5/15/2008	2--5-- 20	Dry No Water	0	
2	5/15/2008	2--5-- 0	Dry No Water	0	
2	5/15/2008	2--5-- 40	Pooled Holes	0	
2	5/15/2008	Targeted	Ditch	0	
2	5/15/2008	Targeted	Flooded Areas	0	
2	5/15/2008	Targeted	Pooled Holes	0	
2	5/19/2008	Targeted	Flooded Areas	0	
2	5/19/2008	Targeted	Flooded Areas	0	
2	5/19/2008	Targeted	Flooded Areas	0	
2	5/19/2008	Targeted	Flooded Areas	0	
2	5/19/2008	Targeted	Flooded Areas	0	
2	5/19/2008	Targeted	Flooded Areas	0	
2	5/19/2008	Targeted	Flooded Areas	0	
2	5/19/2008	Targeted	Flooded Areas	0	
2	5/19/2008	Targeted	Flooded Areas	0	
2	5/19/2008	Targeted	Flooded Areas	0	
2	5/19/2008	Targeted	Flooded Areas	0	
2	5/19/2008	Targeted	Flooded Areas	0	
2	5/19/2008	Targeted	Flooded Areas	0	
2	5/19/2008	Targeted	Panne	0	
2	5/19/2008	Targeted	Pooled Holes	0	
2	5/19/2008	Targeted	Pooled Holes	0	
2	5/19/2008	Targeted	Pooled Holes	0	
2	5/19/2008	Targeted	Pooled Holes	0	
2	5/19/2008	Targeted	Pooled Holes	0	
2	5/19/2008	Targeted	Pooled Holes	0	
2	5/19/2008	Targeted	Pooled Holes	0	
2	5/27/2008	Targeted	Dry No Water	0	
2	5/27/2008	Targeted	Flooded Areas	0	
2	5/27/2008	Targeted	Flooded Areas	0	
2	5/27/2008	Targeted	Flooded Areas	0	
2	5/27/2008	Targeted	Flooded Areas	0	
2	5/27/2008	Targeted	Flooded Areas	0	
2	5/27/2008	Targeted	Flooded Areas	0	
2	5/27/2008	Targeted	Flooded Areas	0	
2	5/27/2008	Targeted	Flooded Areas	0	
2	5/27/2008	Targeted	Panne	0	
2	5/27/2008	Targeted	Panne	0	
2	5/27/2008	Targeted	Panne	0	
2	5/27/2008	Targeted	Panne	0	
2	5/27/2008	Targeted	Panne	0	
2	5/27/2008	Targeted	Panne	0	
2	5/27/2008	Targeted	Panne	0	
2	5/27/2008	Targeted	Panne	0	
2	5/27/2008	Targeted	Pooled Holes	0	
2	5/27/2008	Targeted	Pooled Holes	0	
2	5/27/2008	Targeted	Pooled Holes	0	
2	5/27/2008	Targeted	Pooled Holes	0	
2	5/27/2008	Targeted	Pooled Holes	0	
2	5/27/2008	Targeted	Pooled Holes	0	

Area	Date	Station #	Condition	Total # Larvae	Comments
2	5/27/2008	Targeted	Pooled Holes	0	
2	6/2/2008	Targeted	Dry No Water	0	
2	6/2/2008	Targeted	Flooded Areas	0	
2	6/2/2008	Targeted	Flooded Areas	0	
2	6/2/2008	Targeted	Flooded Areas	0	
2	6/2/2008	Targeted	Flooded Areas	0	
2	6/2/2008	Targeted	Flooded Areas	0	
2	6/2/2008	Targeted	Flooded Areas	0	
2	6/2/2008	Targeted	Flooded Areas	0	
2	6/2/2008	Targeted	Panne	0	
2	6/2/2008	Targeted	Panne	0	
2	6/2/2008	Targeted	Panne	0	
2	6/2/2008	Targeted	Panne	0	
2	6/2/2008	Targeted	Panne	0	
2	6/2/2008	Targeted	Panne	0	
2	6/2/2008	Targeted	Panne	0	
2	6/2/2008	Targeted	Panne	0	
2	6/2/2008	Targeted	Panne	0	
2	6/2/2008	Targeted	Panne	0	
2	6/2/2008	Targeted	Panne	0	
2	6/2/2008	Targeted	Pooled Holes	0	
2	6/2/2008	Targeted	Pooled Holes	0	
2	6/2/2008	Targeted	Pooled Holes	0	
2	6/2/2008	Targeted	Pooled Holes	0	
2	6/2/2008	Targeted	Pooled Holes	0	
2	6/2/2008	Targeted	Pooled Holes	0	
2	6/10/2008	2--1-- 100	Dry No Water	0	
2	6/10/2008	2--1-- 0	Dry No Water	0	
2	6/10/2008	2--1-- 120	Dry No Water	0	
2	6/10/2008	2--1-- 20	Dry No Water	0	
2	6/10/2008	2--1-- 60	Dry No Water	0	
2	6/10/2008	2--1-- 160	Dry No Water	0	
2	6/10/2008	2--1--140	Panne	0	
2	6/10/2008	2--1-- 80	Pooled Holes	0	
2	6/10/2008	2--1-- 40	Pooled Holes	0	
2	6/10/2008	2--2- 40	Ditch	0	tidal channel
2	6/10/2008	2--2-200	Ditch	0	tidal channel
2	6/10/2008	2--2-- 0	Dry No Water	0	
2	6/10/2008	2--2-- 140	Dry No Water	0	
2	6/10/2008	2--2-- 180	Dry No Water	0	
2	6/10/2008	2--2-- 160	Dry No Water	0	
2	6/10/2008	2--2-- 60	Pond	0	
2	6/10/2008	2--2-- 20	Pond	0	
2	6/10/2008	2--2-- 120	Pooled Holes	0	
2	6/10/2008	2--3-- 20	Dry No Water	0	
2	6/10/2008	2--3-- 40	Dry No Water	0	
2	6/10/2008	2--3-- 100	Dry No Water	0	
2	6/10/2008	2--3-- 60	Dry No Water	0	
2	6/10/2008	2--3--200	Dry No Water	0	
2	6/10/2008	2--3--160	Dry No Water	0	
2	6/10/2008	2--3-- 140	Dry No Water	0	
2	6/10/2008	2--3-- 0	Dry No Water	0	
2	6/10/2008	2--3--180	Panne	0	
2	6/10/2008	2--3-- 120	Pond	0	fish fry
2	6/10/2008	2--3-- 80	Pooled Holes	0	tons fish fry
2	6/10/2008	2--4-- 0	Dry No Water	0	
2	6/10/2008	2--4-- 20	Dry No Water	0	
2	6/10/2008	2--4-- 40	Dry No Water	0	
2	6/10/2008	2--4-- 80	Dry No Water	0	
2	6/10/2008	2--4--100	Dry No Water	0	
2	6/10/2008	2--4--120	Dry No Water	0	
2	6/10/2008	2--4-- 60	Panne	0	
2	6/10/2008	2--5-- 0	Dry No Water	0	
2	6/10/2008	2--5-- 80	Dry No Water	0	
2	6/10/2008	2--5-- 60	Dry No Water	0	

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**Wertheim NWR Water Management Demonstration Project Data Report**  
**Mosquito Larvae**  
**2008**

Area	Date	Station #	Condition	Total # Larvae	Comments
2	6/30/2008	Targeted	Panne	0	
2	6/30/2008	Targeted	Panne	0	
2	6/30/2008	Targeted	Pooled Holes	3	
2	6/30/2008	Targeted	Pooled Holes	2	
2	6/30/2008	Targeted	Pooled Holes	0	
2	6/30/2008	Targeted	Pooled Holes	0	
2	6/30/2008	Targeted	Pooled Holes	0	
2	6/30/2008	Targeted	Pooled Holes	0	
2	6/30/2008	Targeted	Pooled Holes	0	
2	6/30/2008	Targeted	Pooled Holes	0	
2	6/30/2008	Targeted	Pooled Holes	0	
2	6/30/2008	Targeted	Pooled Holes	0	
2	7/7/2008	2--1-- 0	Dry No Water	0	
2	7/7/2008	2--1-- 20	Dry No Water	0	
2	7/7/2008	2--1-- 140	Flooded Areas	0	invertebrates
2	7/7/2008	2--1-- 40	Flooded Areas	0	
2	7/7/2008	2--1-- 60	Flooded Areas	0	
2	7/7/2008	2--1-- 80	Flooded Areas	0	
2	7/7/2008	2--1--120	Pooled Holes	0	
2	7/7/2008	2--1-- 100	Pooled Holes	0	fish
2	7/7/2008	2--1--160	Saturated Soil	0	
2	7/7/2008	2--2-- 40	Ditch	0	tidal channel
2	7/7/2008	2--2-- 200	Ditch	0	tidal channel
2	7/7/2008	2--2--180	Dry No Water	0	
2	7/7/2008	2--2-- 160	Dry No Water	0	
2	7/7/2008	2--2-- 140	Dry No Water	0	
2	7/7/2008	2--2-- 0	Dry No Water	0	
2	7/7/2008	2--2-- 80	Panne	1	
2	7/7/2008	2--2-- 60	Pond	0	
2	7/7/2008	2--2-- 100	Pooled Holes	2	
2	7/7/2008	2--2-- 20	Pooled Holes	0	
2	7/7/2008	2--2--120	Pooled Holes	0	
2	7/7/2008	2--3-- 200	Dry No Water	0	
2	7/7/2008	2--3--180	Dry No Water	0	
2	7/7/2008	2--3-- 160	Dry No Water	0	
2	7/7/2008	2--3-- 140	Dry No Water	0	
2	7/7/2008	2--3--120	Pond	0	
2	7/7/2008	2--3-- 40	Pooled Holes	0	
2	7/7/2008	2--3--100	Pooled Holes	0	
2	7/7/2008	2--3-- 60	Pooled Holes	0	
2	7/7/2008	2--3-- 80	Pooled Holes	0	
2	7/7/2008	2--3-- 20	Saturated Soil	0	
2	7/7/2008	2--3-- 0	Saturated Soil	0	
2	7/7/2008	2--4-- 0	Dry No Water	0	
2	7/7/2008	2--4-- 40	Dry No Water	0	
2	7/7/2008	2--4-- 80	Dry No Water	0	
2	7/7/2008	2--4--120	Dry No Water	0	
2	7/7/2008	2--4-- 100	Dry No Water	0	
2	7/7/2008	2--4-- 60	Flooded Areas	0	
2	7/7/2008	2--4-- 20	Panne	6	
2	7/7/2008	2--5-- 80	Dry No Water	0	
2	7/7/2008	2--5-- 60	Dry No Water	0	
2	7/7/2008	2--5-- 40	Dry No Water	0	
2	7/7/2008	2--5-- 20	Dry No Water	0	
2	7/7/2008	2--5-- 0	Dry No Water	0	
2	7/7/2008	Targeted	Ditch	0	sill
2	7/7/2008	Targeted	Panne	2	
2	7/7/2008	Targeted	Panne	0	
2	7/7/2008	Targeted	Panne	0	
2	7/7/2008	Targeted	Panne	0	
2	7/7/2008	Targeted	Panne	0	
2	7/7/2008	Targeted	Panne	0	fish
2	7/7/2008	Targeted	Panne	0	
2	7/7/2008	Targeted	Panne	0	
2	7/7/2008	Targeted	Pooled Holes	0	

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**Wertheim NWR Water Management Demonstration Project Data Report**  
**Mosquito Larvae**  
**2008**

Area	Date	Station #	Condition	Total # Larvae	Comments
2	8/4/2008	2--1--140	Flooded Areas	0	
2	8/4/2008	2--1-- 60	Flooded Areas	0	
2	8/4/2008	2--1-- 40	Pooled Holes	0	
2	8/4/2008	2--1-- 80	Pooled Holes	0	
2	8/4/2008	2--1-- 120	Pooled Holes	0	
2	8/4/2008	2--1--100	Pooled Holes	0	
2	8/4/2008	2--1-- 160	Pooled Holes	0	
2	8/4/2008	2--1-- 20	Saturated Soil	0	
2	8/4/2008	2--1-- 0	Saturated Soil	0	
2	8/4/2008	2--2-- 40	Ditch	0	tidal channel
2	8/4/2008	2--2--200	Ditch	0	tidal channel
2	8/4/2008	2--2-- 180	Dry No Water	0	
2	8/4/2008	2--2-- 80	Flooded Areas	0	
2	8/4/2008	2--2-- 20	Pond	0	
2	8/4/2008	2--2-- 60	Pond	0	
2	8/4/2008	2--2-- 140	Pooled Holes	0	
2	8/4/2008	2--2-- 160	Pooled Holes	0	
2	8/4/2008	2--2-- 120	Pooled Holes	0	
2	8/4/2008	2--2--100	Pooled Holes	0	
2	8/4/2008	2--2-- 0	Saturated Soil	0	
2	8/4/2008	2--3--160	Dry No Water	0	
2	8/4/2008	2--3--200	Dry No Water	0	
2	8/4/2008	2--3-- 40	Flooded Areas	0	
2	8/4/2008	2--3--140	Flooded Areas	0	
2	8/4/2008	2--3-- 20	Flooded Areas	0	
2	8/4/2008	2--3--180	Flooded Areas	0	
2	8/4/2008	2--3-- 80	Flooded Areas	0	
2	8/4/2008	2--3--100	Flooded Areas	0	
2	8/4/2008	2--3-- 60	Flooded Areas	0	
2	8/4/2008	2--3-- 0	Flooded Areas	0	
2	8/4/2008	2--3--120	Pond	0	
2	8/4/2008	2--4-- 80	Dry No Water	0	
2	8/4/2008	2--4--100	Dry No Water	0	
2	8/4/2008	2--4--120	Dry No Water	0	
2	8/4/2008	2--4-- 20	Dry No Water	0	
2	8/4/2008	2--4-- 60	Flooded Areas	1	
2	8/4/2008	2--4-- 40	Panne	0	
2	8/4/2008	2--4-- 0	Pooled Holes	0	
2	8/4/2008	2--5-- 40	Dry No Water	0	
2	8/4/2008	2--5-- 20	Dry No Water	0	
2	8/4/2008	2--5-- 0	Dry No Water	0	
2	8/4/2008	2--5-- 60	Dry No Water	0	
2	8/4/2008	2--5-- 80	Dry No Water	0	
2	8/4/2008	Targeted	Panne	0	
2	8/4/2008	Targeted	Pooled Holes	3	
2	8/6/2008	Targeted	Panne	0	
2	8/11/2008	Targeted	Panne	3	
2	8/11/2008	Targeted	Panne	2	
2	8/11/2008	Targeted	Panne	0	
2	8/11/2008	Targeted	Panne	0	
2	8/11/2008	Targeted	Panne	0	
2	8/11/2008	Targeted	Panne	0	reference at the stake 2 120
2	8/11/2008	Targeted	Panne	0	
2	8/11/2008	Targeted	Panne	0	
2	8/11/2008	Targeted	Panne	0	
2	8/11/2008	Targeted	Panne	0	
2	8/11/2008	Targeted	Panne	0	
2	8/11/2008	Targeted	Panne	0	
2	8/11/2008	Targeted	Panne	0	muddy hard to assess
2	8/11/2008	Targeted	Panne	0	
2	8/11/2008	Targeted	Panne	0	
2	8/11/2008	Targeted	Pond	0	

**Wertheim NWR Water Management Demonstration Project Data Report**  
**Mosquito Larvae**  
**2008**

Area	Date	Station #	Condition	Total # Larvae	Comments
2	8/11/2008	Targeted	Pooled Holes	2	
2	8/11/2008	Targeted	Pooled Holes	0	
2	8/11/2008	Targeted	Pooled Holes	0	
2	8/11/2008	Targeted	Saturated Soil	0	inverts lot of H2O
2	8/11/2008	Targeted	Saturated Soil	0	
2	8/18/2008	Targeted	Dry No Water	0	
2	8/18/2008	Targeted	Dry No Water	0	
2	8/18/2008	Targeted	Dry No Water	0	
2	8/18/2008	Targeted	Panne	0	
2	8/18/2008	Targeted	Panne	0	
2	8/18/2008	Targeted	Panne	0	
2	8/18/2008	Targeted	Panne	0	
2	8/18/2008	Targeted	Panne	0	
2	8/18/2008	Targeted	Panne	0	
2	8/18/2008	Targeted	Panne	0	
2	8/18/2008	Targeted	Panne	0	
2	8/18/2008	Targeted	Panne	0	a lot H2O
2	8/18/2008	Targeted	Panne	0	
2	8/18/2008	Targeted	Panne	0	
2	8/18/2008	Targeted	Panne	0	
2	8/18/2008	Targeted	Panne	0	
2	8/18/2008	Targeted	Panne	0	
2	8/18/2008	Targeted	Pooled Holes	0	
2	8/18/2008	Targeted	Pooled Holes	0	
2	8/18/2008	Targeted	Pooled Holes	0	
2	8/18/2008	Targeted	Pooled Holes	0	
2	8/18/2008	Targeted	Pooled Holes	0	
2	8/18/2008	Targeted	Pooled Holes	0	
2	8/18/2008	Targeted	Pooled Holes	0	large mummichog
2	8/25/2008	Targeted	Dry No Water	0	
2	8/25/2008	Targeted	Dry No Water	0	
2	8/25/2008	Targeted	Dry No Water	0	
2	8/25/2008	Targeted	Dry No Water	0	
2	8/25/2008	Targeted	Dry No Water	0	
2	8/25/2008	Targeted	Dry No Water	0	
2	8/25/2008	Targeted	Dry No Water	0	
2	8/25/2008	Targeted	Flooded Areas	0	
2	8/25/2008	Targeted	Flooded Areas	0	
2	8/25/2008	Targeted	Flooded Areas	0	snails
2	8/25/2008	Targeted	Panne	0	
2	8/25/2008	Targeted	Panne	0	
2	8/25/2008	Targeted	Panne	0	
2	8/25/2008	Targeted	Pooled Holes	0	
2	9/2/2008	Targeted	Dry No Water	0	
2	9/2/2008	Targeted	Dry No Water	0	
2	9/2/2008	Targeted	Dry No Water	0	
2	9/2/2008	Targeted	Dry No Water	0	
2	9/2/2008	Targeted	Dry No Water	0	
2	9/2/2008	Targeted	Dry No Water	0	
2	9/2/2008	Targeted	Panne	20	
2	9/2/2008	Targeted	Panne	2	
2	9/2/2008	Targeted	Panne	2	
2	9/2/2008	Targeted	Panne	0	
2	9/2/2008	Targeted	Panne	0	
2	9/2/2008	Targeted	Panne	0	
2	9/2/2008	Targeted	Pooled Holes	4	
2	9/2/2008	Targeted	Pooled Holes	0	
2	9/2/2008	Targeted	Pooled Holes	0	
2	9/2/2008	Targeted	Pooled Holes	0	
2	9/2/2008	Targeted	Pooled Holes	0	
2	9/2/2008	Targeted	Pooled Holes	0	
2	9/2/2008	Targeted	Pooled Holes	0	



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**2008**

Area	Date	Station #	Condition	Total # Larvae	Comments
2	9/2/2008	Targeted	Pooled Holes	0	
2	9/2/2008	Targeted	Pooled Holes	0	
2	9/2/2008	Targeted	Pooled Holes	0	reference
2	9/2/2008	Targeted	Pooled Holes	0	
2	9/2/2008	Targeted	Pooled Holes	0	
2	9/10/2008	2--1-- 20	Ditch	0	sill
2	9/10/2008	2--1-- 140	Panne	0	
2	9/10/2008	2--1-- 60	Panne	0	
2	9/10/2008	2--1-- 100	Pooled Holes	0	
2	9/10/2008	2--1-- 40	Pooled Holes	0	
2	9/10/2008	2--1-- 80	Pooled Holes	0	
2	9/10/2008	2--1-- 120	Pooled Holes	0	
2	9/10/2008	2--1-- 0	Saturated Soil	0	
2	9/10/2008	2--1-- 160	Saturated Soil	0	
2	9/10/2008	2--2-- 200	Ditch	0	tidal channel
2	9/10/2008	2--2-- 40	Ditch	0	tidal channel
2	9/10/2008	2--2-- 180	Dry No Water	0	
2	9/10/2008	2--2-- 80	Panne	0	
2	9/10/2008	2--2-- 60	Pond	0	
2	9/10/2008	2--2-- 20	Pond	0	
2	9/10/2008	2--2-- 120	Pooled Holes	0	
2	9/10/2008	2--2-- 140	Pooled Holes	0	
2	9/10/2008	2--2-- 100	Pooled Holes	0	
2	9/10/2008	2--2-- 160	Saturated Soil	0	
2	9/10/2008	2--2-- 0	Saturated Soil	0	
2	9/10/2008	2--3-- 200	Dry No Water	0	
2	9/10/2008	2--3-- 20	Flooded Areas	0	
2	9/10/2008	2--3-- 100	Flooded Areas	0	
2	9/10/2008	2--3-- 60	Flooded Areas	0	
2	9/10/2008	2--3-- 80	Flooded Areas	0	
2	9/10/2008	2--3-- 180	Panne	0	
2	9/10/2008	2--3-- 120	Pond	0	
2	9/10/2008	2--3-- 140	Pooled Holes	0	
2	9/10/2008	2--3-- 160	Pooled Holes	0	
2	9/10/2008	2--3-- 40	Pooled Holes	0	
2	9/10/2008	2--3-- 0	Saturated Soil	0	
2	9/10/2008	2--4-- 60	Dry No Water	0	
2	9/10/2008	2--4-- 120	Dry No Water	0	
2	9/10/2008	2--4-- 100	Panne	0	
2	9/10/2008	2--4-- 80	Panne	0	
2	9/10/2008	2--4-- 20	Panne	0	
2	9/10/2008	2--4-- 40	Panne	0	
2	9/10/2008	2--4-- 0	Panne	0	
2	9/10/2008	2--5-- 40	Dry No Water	0	
2	9/10/2008	2--5-- 80	Dry No Water	0	
2	9/10/2008	2--5-- 20	Dry No Water	0	
2	9/10/2008	2--5-- 0	Dry No Water	0	
2	9/10/2008	2--5-- 60	Flooded Areas	0	
2	9/10/2008	Targeted	Panne	0	
2	9/10/2008	Targeted	Panne	0	
2	9/10/2008	Targeted	Panne	0	
2	9/10/2008	Targeted	Pooled Holes	0	
2	9/10/2008	Targeted	Pooled Holes	0	
2	9/15/2008	Targeted	Flooded Areas	0	reference at a stake 3 00
2	9/15/2008	Targeted	Flooded Areas	0	whole site has H2O
2	9/17/2008	2--2-- 80	Panne	0	yellowlegs
2	9/17/2008	Targeted	Panne	1	
2	9/17/2008	Targeted	Panne	0	
2	9/17/2008	Targeted	Panne	0	
2	9/17/2008	Targeted	Panne	0	
2	9/17/2008	Targeted	Panne	0	
2	9/17/2008	Targeted	Panne	0	
2	9/17/2008	Targeted	Panne	0	
2	9/17/2008	Targeted	Panne	0	

Area	Date	Station #	Condition	Total # Larvae	Comments
2	9/17/2008	Targeted	Panne	0	
2	9/17/2008	Targeted	Panne	0	
2	9/17/2008	Targeted	Panne	0	
2	9/17/2008	Targeted	Panne	0	
2	9/17/2008	Targeted	Panne	0	
2	9/17/2008	Targeted	Panne	0	
2	9/17/2008	Targeted	Panne	0	
2	9/17/2008	Targeted	Panne	0	
2	9/17/2008	Targeted	Pooled Holes	0	
2	9/17/2008	Targeted	Pooled Holes	0	
2	9/17/2008	Targeted	Pooled Holes	0	
2	9/17/2008	Targeted	Pooled Holes	0	
2	9/17/2008	Targeted	Pooled Holes	0	
2	9/17/2008	Targeted	Pooled Holes	0	
2	9/17/2008	Targeted	Pooled Holes	0	
2	9/17/2008	Targeted	Pooled Holes	0	
3	5/5/2008	Targeted	Dry No Water	0	
3	5/5/2008	Targeted	Pooled Holes	10	
3	5/5/2008	Targeted	Pooled Holes	0	
3	5/5/2008	Targeted	Pooled Holes	4	
3	5/5/2008	Targeted	Pooled Holes	3	
3	5/5/2008	Targeted	Pooled Holes	1	
3	5/5/2008	Targeted	Pooled Holes	0	
3	5/5/2008	Targeted	Pooled Holes	0	
3	5/5/2008	Targeted	Pooled Holes	0	
3	5/5/2008	Targeted	Pooled Holes	0	
3	5/5/2008	Targeted	Pooled Holes	0	
3	5/5/2008	Targeted	Pooled Holes	0	
3	5/5/2008	Targeted	Pooled Holes	0	
3	5/5/2008	Targeted	Pooled Holes	0	
3	5/5/2008	Targeted	Pooled Holes	0	
3	5/5/2008	Targeted	Pooled Holes	0	
3	5/5/2008	Targeted	Pooled Holes	0	
3	5/5/2008	Targeted	Pooled Holes	0	
3	5/5/2008	Targeted	Pooled Holes	0	
3	5/5/2008	Targeted	Pooled Holes	0	
3	5/5/2008	Targeted	Pooled Holes	0	
3	5/5/2008	Targeted	Pooled Holes	0	
3	5/5/2008	Targeted	Pooled Holes	0	
3	5/5/2008	Targeted	Pooled Holes	0	
3	5/5/2008	Targeted	Pooled Holes	0	
3	5/5/2008	Targeted	Pooled Holes	0	
3	5/5/2008	Targeted	Pooled Holes	0	
3	5/5/2008	Targeted	Pooled Holes	0	
3	5/5/2008	Targeted	Pooled Holes	0	
3	5/5/2008	Targeted	Saturated Soil	0	
3	5/14/2008	3--1--180	Flooded	0	
3	5/14/2008	3--1-- 20	Flooded Areas	2	
3	5/14/2008	3--1-- 40	Flooded Areas	1	
3	5/14/2008	3--1--200	Flooded Areas	0	no stake
3	5/14/2008	3--1- 160	Flooded Areas	0	
3	5/14/2008	3--1-- 80	Flooded Areas	0	
3	5/14/2008	3--1-- 0	Flooded Areas	0	
3	5/14/2008	3--1-- 60	Flooded Areas	0	
3	5/14/2008	3--1--140	Flooded Areas	0	
3	5/14/2008	3--1- 120	Flooded Areas	0	
3	5/14/2008	3--1--100	Flooded Areas	0	
3	5/14/2008	3--2- 40	Flooded Areas	0	
3	5/14/2008	3--2- 60	Flooded Areas	0	

[illegible]

[illegible]

Area	Date	Station #	Condition	Total # Larvae	Comments
3	6/9/2008	3--2--120	Dry No Water	0	
3	6/9/2008	3--2--200	Dry No Water	0	
3	6/9/2008	3--2-- 40	Panne	0	
3	6/9/2008	3--2--140	Panne	0	
3	6/9/2008	3--2--160	Panne	0	
3	6/9/2008	3--2--180	Panne	0	
3	6/9/2008	3--2-- 80	Pond	0	
3	6/9/2008	3--3--100	Dry No Water	0	
3	6/9/2008	3--3--120	Dry No Water	0	
3	6/9/2008	3--3-- 20	Dry No Water	0	
3	6/9/2008	3--3-- 0	Dry No Water	0	
3	6/9/2008	3--3-- 80	Dry No Water	0	
3	6/9/2008	3--3-- 60	Pooled Holes	0	
3	6/9/2008	3--3-- 40	Pooled Holes	0	
3	6/9/2008	3--4-- 60	Dry No Water	0	
3	6/9/2008	3--4-- 20	Dry No Water	0	
3	6/9/2008	3--4-- 0	Dry No Water	0	
3	6/9/2008	3--4-- 40	Dry No Water	0	
3	6/9/2008	3--4--100	Dry No Water	0	
3	6/9/2008	3--4--120	Pooled Holes	0	
3	6/9/2008	3--4-- 80	Pooled Holes	0	
3	6/9/2008	Targeted	Dry No Water	0	
3	6/9/2008	Targeted	Dry No Water	0	
3	6/9/2008	Targeted	Panne	1	
3	6/9/2008	Targeted	Panne	1	
3	6/9/2008	Targeted	Panne	0	
3	6/9/2008	Targeted	Panne	0	
3	6/9/2008	Targeted	Pond	0	
3	6/9/2008	Targeted	Pooled Holes	0	
3	6/9/2008	Targeted	Pooled Holes	0	
3	6/9/2008	Targeted	Pooled Holes	0	
3	6/9/2008	Targeted	Pooled Holes	0	
3	6/9/2008	Targeted	Pooled Holes	0	
3	6/9/2008	Targeted	Pooled Holes	0	
3	6/16/2008	Targeted	Dry No Water	0	
3	6/16/2008	Targeted	Dry No Water	0	
3	6/16/2008	Targeted	Dry No Water	0	
3	6/16/2008	Targeted	Dry No Water	0	
3	6/16/2008	Targeted	Dry No Water	0	
3	6/16/2008	Targeted	Dry No Water	0	
3	6/16/2008	Targeted	Dry No Water	0	
3	6/16/2008	Targeted	Dry No Water	0	
3	6/16/2008	Targeted	Dry No Water	0	
3	6/16/2008	Targeted	Dry No Water	0	
3	6/16/2008	Targeted	Dry No Water	0	
3	6/16/2008	Targeted	Dry No Water	0	
3	6/16/2008	Targeted	Pooled Holes	5	
3	6/16/2008	Targeted	Pooled Holes	3	
3	6/16/2008	Targeted	Pooled Holes	0	
3	6/16/2008	Targeted	Pooled Holes	0	
3	6/16/2008	Targeted	Pooled Holes	0	
3	6/16/2008	Targeted	Pooled Holes	0	
3	6/16/2008	Targeted	Pooled Holes	0	
3	6/16/2008	Targeted	Pooled Holes	0	
3	6/16/2008	Targeted	Pooled Holes	0	
3	6/16/2008	Targeted	Pooled Holes	0	
3	6/16/2008	Targeted	Pooled Holes	0	
3	6/16/2008	Targeted	Pooled Holes	0	
3	6/16/2008	Targeted	Pooled Holes	0	
3	6/17/2008	Targeted	Ditch	0	fish D-5
3	6/17/2008	Targeted	Standing Water	2	
3	6/19/2008	Targeted	Pooled Holes	48	
3	6/19/2008	Targeted	Pooled Holes	35	
3	6/19/2008	Targeted	Pooled Holes	32	



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**2008**

Area	Date	Station #	Condition	Total # Larvae	Comments
3	6/19/2008	Targeted	Pooled Holes	23	
3	6/19/2008	Targeted	Pooled Holes	16	
3	6/19/2008	Targeted	Pooled Holes	15	
3	6/19/2008	Targeted	Pooled Holes	15	
3	6/19/2008	Targeted	Pooled Holes	15	
3	6/19/2008	Targeted	Pooled Holes	12	
3	6/19/2008	Targeted	Pooled Holes	10	
3	6/19/2008	Targeted	Pooled Holes	9	
3	6/19/2008	Targeted	Pooled Holes	9	
3	6/19/2008	Targeted	Pooled Holes	9	
3	6/19/2008	Targeted	Pooled Holes	7	
3	6/19/2008	Targeted	Pooled Holes	6	
3	6/19/2008	Targeted	Pooled Holes	5	
3	6/19/2008	Targeted	Pooled Holes	4	
3	6/19/2008	Targeted	Pooled Holes	0	
3	6/19/2008	Targeted	Pooled Holes	0	
3	6/19/2008	Targeted	Pooled Holes	0	
3	6/19/2008	Targeted	Pooled Holes	0	
3	6/19/2008	Targeted	Pooled Holes	0	
3	6/19/2008	Targeted	Pooled Holes	0	
3	6/19/2008	Targeted	Pooled Holes	0	
3	6/19/2008	Targeted	Pooled Holes	0	
3	6/19/2008	Targeted	Pooled Holes	0	
3	6/19/2008	Targeted	Pooled Holes	0	
3	6/19/2008	Targeted	Pooled Holes	0	
3	6/23/2008	Targeted	Dry No Water	0	
3	6/23/2008	Targeted	Dry No Water	0	
3	6/23/2008	Targeted	Dry No Water	0	
3	6/23/2008	Targeted	Dry No Water	0	
3	6/23/2008	Targeted	Dry No Water	0	
3	6/23/2008	Targeted	Dry No Water	0	
3	6/23/2008	Targeted	Panne	0	
3	6/23/2008	Targeted	Panne	0	
3	6/23/2008	Targeted	Panne	0	
3	6/23/2008	Targeted	Panne	0	
3	6/23/2008	Targeted	Panne	0	
3	6/23/2008	Targeted	Panne	0	
3	6/23/2008	Targeted	Panne	0	
3	6/23/2008	Targeted	Panne	0	
3	6/23/2008	Targeted	Pooled Holes	10	
3	6/23/2008	Targeted	Pooled Holes	7	
3	6/23/2008	Targeted	Pooled Holes	5	
3	6/23/2008	Targeted	Pooled Holes	4	
3	6/23/2008	Targeted	Pooled Holes	4	
3	6/23/2008	Targeted	Pooled Holes	3	
3	6/23/2008	Targeted	Pooled Holes	2	
3	6/23/2008	Targeted	Pooled Holes	2	
3	6/23/2008	Targeted	Pooled Holes	2	
3	6/23/2008	Targeted	Pooled Holes	2	
3	6/23/2008	Targeted	Pooled Holes	1	
3	6/23/2008	Targeted	Pooled Holes	1	
3	6/23/2008	Targeted	Pooled Holes	0	
3	6/23/2008	Targeted	Pooled Holes	0	
3	6/23/2008	Targeted	Pooled Holes	0	
3	6/23/2008	Targeted	Pooled Holes	0	
3	6/23/2008	Targeted	Pooled Holes	0	
3	6/30/2008	Targeted	Panne	0	
3	6/30/2008	Targeted	Panne	0	
3	6/30/2008	Targeted	Panne	0	
3	6/30/2008	Targeted	Panne	0	
3	6/30/2008	Targeted	Panne	0	
3	6/30/2008	Targeted	Panne	0	
3	6/30/2008	Targeted	Panne	0	
3	6/30/2008	Targeted	Panne	0	

**Wertheim NWR Water Management Demonstration Project Data Report**  
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**2008**

Area	Date	Station #	Condition	Total # Larvae	Comments
3	6/30/2008	Targeted	Panne	0	
3	6/30/2008	Targeted	Panne	0	
3	6/30/2008	Targeted	Pooled Holes	3	
3	6/30/2008	Targeted	Pooled Holes	3	
3	6/30/2008	Targeted	Pooled Holes	2	
3	6/30/2008	Targeted	Pooled Holes	1	
3	6/30/2008	Targeted	Pooled Holes	0	
3	6/30/2008	Targeted	Pooled Holes	0	
3	6/30/2008	Targeted	Pooled Holes	0	
3	6/30/2008	Targeted	Pooled Holes	0	
3	6/30/2008	Targeted	Pooled Holes	0	
3	6/30/2008	Targeted	Pooled Holes	0	
3	6/30/2008	Targeted	Pooled Holes	0	
3	6/30/2008	Targeted	Pooled Holes	0	
3	6/30/2008	Targeted	Pooled Holes	0	
3	7/7/2008	3--1-- 60	Dry	0	
3	7/7/2008	3--1-- 80	Dry	0	
3	7/7/2008	3--1-- 100	Dry	0	
3	7/7/2008	3--1-- 140	Dry	0	
3	7/7/2008	3--1-- 160	Dry	0	
3	7/7/2008	3--1-- 180	Dry	0	
3	7/7/2008	3--1-- 200	Dry	0	
3	7/7/2008	3--1-- 0	Pooled	4	
3	7/7/2008	3--1-- 40	Pooled	1	
3	7/7/2008	3--1-- 20	Pooled	0	
3	7/7/2008	3--1-- 120	Pooled	0	
3	7/7/2008	3--2-- 20	Ditch	0	
3	7/7/2008	3--2-- 80	Dry	0	
3	7/7/2008	3--2-- 40	Dry	0	
3	7/7/2008	3--2-- 140	Dry No Water	0	
3	7/7/2008	3--2-- 200	Dry No Water	0	
3	7/7/2008	3--2-- 120	Dry No Water	0	
3	7/7/2008	3--2-- 180	Dry No Water	0	fish
3	7/7/2008	3--2-- 160	Dry No Water	0	
3	7/7/2008	3--2-- 100	Fish Reservoir	0	
3	7/7/2008	3--2-- 60	Pooled	0	
3	7/7/2008	3--2-- 0	Pooled	0	
3	7/7/2008	3--3-- 20	Dry No Water	0	
3	7/7/2008	3--3-- 0	Dry No Water	0	
3	7/7/2008	3--3-- 40	Pooled Holes	0	
3	7/7/2008	3--3-- 100	Saturated Soil	0	
3	7/7/2008	3--3-- 60	Saturated Soil	0	
3	7/7/2008	3--3-- 80	Saturated Soil	0	
3	7/7/2008	3--3-- 120	Saturated Soil	0	
3	7/7/2008	3--4-- 20	Dry No Water	0	
3	7/7/2008	3--4-- 0	Dry No Water	0	
3	7/7/2008	3--4-- 40	Dry No Water	0	
3	7/7/2008	3--4-- 60	Dry No Water	0	
3	7/7/2008	3--4-- 80	Pooled Holes	0	
3	7/7/2008	3--4-- 100	Saturated Soil	0	
3	7/7/2008	3--4-- 120	Saturated Soil	0	
3	7/7/2008	Targeted	Dry	0	
3	7/7/2008	Targeted	Dry	0	
3	7/7/2008	Targeted	Dry	0	
3	7/7/2008	Targeted	Dry	0	ref
3	7/7/2008	Targeted	Flooded Areas	0	fish
3	7/7/2008	Targeted	Panne	5	
3	7/7/2008	Targeted	Panne	1	
3	7/7/2008	Targeted	Pond	0	
3	7/7/2008	Targeted	Pooled	2	
3	7/7/2008	Targeted	Pooled	1	
3	7/7/2008	Targeted	Pooled	1	sal
3	7/7/2008	Targeted	Pooled	1	sal
3	7/7/2008	Targeted	Pooled	0	
3	7/7/2008	Targeted	Pooled	0	

**Wertheim NWR Water Management Demonstration Project Data Report**  
**Mosquito Larvae**  
**2008**

Area	Date	Station #	Condition	Total # Larvae	Comments
3	7/7/2008	Targeted	Pooled	0	
3	7/7/2008	Targeted	Pooled	0	
3	7/7/2008	Targeted	Pooled	0	
3	7/7/2008	Targeted	Pooled Holes	0	
3	7/7/2008	Targeted	Pooled Holes	0	fish
3	7/14/2008	Targeted	Dry No Water	0	
3	7/14/2008	Targeted	Dry No Water	0	
3	7/14/2008	Targeted	Dry No Water	0	
3	7/14/2008	Targeted	Dry No Water	0	
3	7/14/2008	Targeted	Dry No Water	0	
3	7/14/2008	Targeted	Dry No Water	0	
3	7/14/2008	Targeted	Dry No Water	0	
3	7/14/2008	Targeted	Dry No Water	0	
3	7/14/2008	Targeted	Dry No Water	0	
3	7/14/2008	Targeted	Dry No Water	0	
3	7/14/2008	Targeted	Dry No Water	0	
3	7/14/2008	Targeted	Dry No Water	0	
3	7/14/2008	Targeted	Dry No Water	0	
3	7/14/2008	Targeted	Dry No Water	0	
3	7/14/2008	Targeted	Dry No Water	0	
3	7/14/2008	Targeted	Dry No Water	0	
3	7/14/2008	Targeted	Dry No Water	0	
3	7/14/2008	Targeted	Dry No Water	0	
3	7/14/2008	Targeted	Dry No Water	0	
3	7/14/2008	Targeted	Pooled Holes	0	
3	7/14/2008	Targeted	Pooled Holes	0	
3	7/14/2008	Targeted	Pooled Holes	0	
3	7/14/2008	Targeted	Pooled Holes	0	
3	7/14/2008	Targeted	Pooled Holes	0	
3	7/21/2008	Targeted	Flooded Areas	1	
3	7/21/2008	Targeted	Flooded Areas	0	
3	7/21/2008	Targeted	Flooded Areas	0	
3	7/21/2008	Targeted	Panne	7	
3	7/21/2008	Targeted	Panne	0	
3	7/21/2008	Targeted	Panne	0	
3	7/21/2008	Targeted	Panne	0	
3	7/21/2008	Targeted	Panne	0	
3	7/21/2008	Targeted	Panne	0	
3	7/21/2008	Targeted	Panne	0	
3	7/21/2008	Targeted	Panne	0	
3	7/21/2008	Targeted	Panne	0	
3	7/21/2008	Targeted	Panne	0	
3	7/21/2008	Targeted	Panne	0	
3	7/21/2008	Targeted	Panne	0	
3	7/21/2008	Targeted	Panne	0	
3	7/21/2008	Targeted	Panne	0	
3	7/21/2008	Targeted	Panne	0	
3	7/21/2008	Targeted	Panne	0	
3	7/21/2008	Targeted	Panne	0	
3	7/21/2008	Targeted	Panne	0	
3	7/21/2008	Targeted	Panne	0	
3	7/21/2008	Targeted	Panne	0	
3	7/28/2008	Targeted	Flooded Areas	0	
3	7/28/2008	Targeted	Panne	0	
3	7/28/2008	Targeted	Panne	0	
3	7/28/2008	Targeted	Panne	0	
3	7/28/2008	Targeted	Panne	0	
3	7/28/2008	Targeted	Panne	0	
3	7/28/2008	Targeted	Panne	0	
3	7/28/2008	Targeted	Panne	0	
3	7/28/2008	Targeted	Panne	0	

**Wertheim NWR Water Management Demonstration Project Data Report**  
**Mosquito Larvae**  
**2008**

Area	Date	Station #	Condition	Total # Larvae	Comments
3	7/28/2008	Targeted	Panne	0	
3	7/28/2008	Targeted	Panne	0	
3	7/28/2008	Targeted	Panne	0	
3	7/28/2008	Targeted	Panne	0	
3	7/28/2008	Targeted	Panne	0	
3	7/28/2008	Targeted	Panne	0	
3	7/28/2008	Targeted	Panne	0	
3	7/28/2008	Targeted	Pooled Holes	5	cx sal
3	7/28/2008	Targeted	Pooled Holes	2	cx sal
3	7/28/2008	Targeted	Pooled Holes	0	
3	7/28/2008	Targeted	Pooled Holes	0	
3	7/28/2008	Targeted	Pooled Holes	0	
3	7/28/2008	Targeted	Pooled Holes	0	
3	7/28/2008	Targeted	Pooled Holes	0	
3	7/28/2008	Targeted	Pooled Holes	0	
3	7/28/2008	Targeted	Pooled Holes	0	
3	7/28/2008	Targeted	Pooled Holes	0	
3	7/28/2008	Targeted	Pooled Holes	0	
3	8/4/2008	3--1-- 80	Dry No Water	0	
3	8/4/2008	3--1--200	Dry No Water	0	
3	8/4/2008	3--1--180	Dry No Water	0	
3	8/4/2008	3--1--120	Panne	0	
3	8/4/2008	3--1--140	Panne	0	
3	8/4/2008	3--1--160	Panne	0	
3	8/4/2008	3--1--100	Panne	0	
3	8/4/2008	3--1-- 20	Pooled Holes	5	sal
3	8/4/2008	3--1-- 40	Pooled Holes	2	sal
3	8/4/2008	3--1-- 60	Pooled Holes	2	sal
3	8/4/2008	3--1-- 0	Pooled Holes	1	sal
3	8/4/2008	3--2-- 60	Dry No Water	0	
3	8/4/2008	3--2--140	Dry No Water	0	
3	8/4/2008	3--2-- 20	Panne	0	
3	8/4/2008	3--2-- 0	Panne	0	
3	8/4/2008	3--2--100	Panne	0	
3	8/4/2008	3--2-- 80	Pond	0	
3	8/4/2008	3--2-- 40	Pooled Holes	0	
3	8/4/2008	3--2--160	Pooled Holes	0	
3	8/4/2008	3--2--180	Pooled Holes	0	fish
3	8/4/2008	3--2--120	Pooled Holes	0	
3	8/4/2008	3--2--200	Saturated Soil	0	
3	8/4/2008	3--3-- 20	Dry No Water	0	
3	8/4/2008	3--3-- 40	Pooled Holes	0	
3	8/4/2008	3--3--100	Pooled Holes	0	
3	8/4/2008	3--3-- 60	Pooled Holes	0	
3	8/4/2008	3--3-- 0	Saturated Soil	0	
3	8/4/2008	3--3--120	Saturated Soil	0	
3	8/4/2008	3--3-- 80	Saturated Soil	0	
3	8/4/2008	3--4-- 40	Dry No Water	0	
3	8/4/2008	3--4-- 80	Pooled Holes	1	
3	8/4/2008	3--4--120	Pooled Holes	0	
3	8/4/2008	3--4--100	Saturated Soil	0	
3	8/4/2008	3--4-- 20	Saturated Soil	0	
3	8/4/2008	3--4-- 0	Saturated Soil	0	
3	8/4/2008	3--4-- 60	Saturated Soil	0	
3	8/4/2008	Targeted	Flooded Areas	0	
3	8/4/2008	Targeted	Pond	0	too much H2O
3	8/4/2008	Targeted	Pond	0	lot of H2O
3	8/4/2008	Targeted	Pooled Holes	6	sal and ae
3	8/4/2008	Targeted	Pooled Holes	4	sal
3	8/4/2008	Targeted	Pooled Holes	3	sal
3	8/4/2008	Targeted	Pooled Holes	0	a□ □sal
3	8/4/2008	Targeted	Pooled Holes	0	
3	8/4/2008	Targeted	Pooled Holes	0	
3	8/4/2008	Targeted	Pooled Holes	0	

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**Wertheim NWR Water Management Demonstration Project Data Report**  
**Mosquito Larvae**  
**2008**

Area	Date	Station #	Condition	Total # Larvae	Comments
3	8/25/2008	Targeted	Dry No Water	0	
3	8/25/2008	Targeted	Dry No Water	0	
3	8/25/2008	Targeted	Dry No Water	0	
3	8/25/2008	Targeted	Dry No Water	0	
3	8/25/2008	Targeted	Dry No Water	0	
3	8/25/2008	Targeted	Dry No Water	0	
3	8/25/2008	Targeted	Dry No Water	0	
3	8/25/2008	Targeted	Dry No Water	0	
3	8/25/2008	Targeted	Dry No Water	0	
3	8/25/2008	Targeted	Dry No Water	0	
3	8/25/2008	Targeted	Dry No Water	0	
3	8/25/2008	Targeted	Dry No Water	0	
3	8/25/2008	Targeted	Dry No Water	0	
3	8/25/2008	Targeted	Pooled Holes	0	fish
3	9/2/2008	Targeted	Dry No Water	0	
3	9/2/2008	Targeted	Dry No Water	0	
3	9/2/2008	Targeted	Dry No Water	0	
3	9/2/2008	Targeted	Dry No Water	0	
3	9/2/2008	Targeted	Dry No Water	0	
3	9/2/2008	Targeted	Dry No Water	0	
3	9/2/2008	Targeted	Dry No Water	0	
3	9/2/2008	Targeted	Dry No Water	0	
3	9/2/2008	Targeted	Dry No Water	0	
3	9/2/2008	Targeted	Dry No Water	0	
3	9/2/2008	Targeted	Dry No Water	0	
3	9/2/2008	Targeted	Panne	11	
3	9/2/2008	Targeted	Panne	0	
3	9/2/2008	Targeted	Panne	0	inverts
3	9/2/2008	Targeted	Pooled Holes	50	little H2O
3	9/2/2008	Targeted	Pooled Holes	25	
3	9/2/2008	Targeted	Pooled Holes	5	
3	9/2/2008	Targeted	Pooled Holes	4	
3	9/2/2008	Targeted	Pooled Holes	0	
3	9/2/2008	Targeted	Saturated Soil	0	
3	9/8/2008	3--1-- 80	Ditch	0	
3	9/8/2008	3--1-- 180	Dry No Water	0	
3	9/8/2008	3--1-- 100	Dry No Water	0	
3	9/8/2008	3--1-- 200	Dry No Water	0	
3	9/8/2008	3--1-- 0	Flooded Areas	6	
3	9/8/2008	3--1-- 20	Flooded Areas	1	
3	9/8/2008	3--1-- 160	Panne	0	
3	9/8/2008	3--1-- 40	Panne	0	
3	9/8/2008	3--1-- 120	Panne	0	
3	9/8/2008	3--1-- 60	Panne	0	
3	9/8/2008	3--1-- 140	Panne	0	
3	9/8/2008	3--2-- 0	Dry No Water	0	
3	9/8/2008	3--2-- 120	Dry No Water	0	
3	9/8/2008	3--2-- 60	Dry No Water	0	
3	9/8/2008	3--2-- 100	Dry No Water	0	
3	9/8/2008	3--2-- 200	Dry No Water	0	
3	9/8/2008	3--2-- 20	Panne	0	
3	9/8/2008	3--2-- 40	Panne	0	
3	9/8/2008	3--2-- 140	Panne	0	
3	9/8/2008	3--2-- 160	Panne	0	
3	9/8/2008	3--2-- 80	Pond	0	
3	9/8/2008	3--2-- 180	Pooled Holes	1	
3	9/8/2008	3--3-- 0	Dry No Water	0	
3	9/8/2008	3--3-- 20	Dry No Water	0	
3	9/8/2008	3--3-- 40	Pooled Holes	2	
3	9/8/2008	3--3-- 100	Pooled Holes	0	
3	9/8/2008	3--3-- 60	Pooled Holes	0	
3	9/8/2008	3--3-- 120	Saturated Soil	0	
3	9/8/2008	3--3-- 80	Saturated Soil	0	

Area	Date	Station #	Condition	Total # Larvae	Comments
3	9/8/2008	3--4-- 40	Dry No Water	0	
3	9/8/2008	3--4-- 60	Dry No Water	0	
3	9/8/2008	3--4-- 20	Dry No Water	0	
3	9/8/2008	3--4--120	Pooled Holes	0	
3	9/8/2008	3--4--100	Pooled Holes	0	
3	9/8/2008	3--4-- 80	Pooled Holes	0	
3	9/8/2008	3--4-- 0	Saturated Soil	0	
3	9/8/2008	Targeted	Panne	0	
3	9/8/2008	Targeted	Panne	0	
3	9/8/2008	Targeted	Panne	0	
3	9/8/2008	Targeted	Pond	0	
3	9/8/2008	Targeted	Pooled Holes	2	
3	9/8/2008	Targeted	Pooled Holes	0	
3	9/8/2008	Targeted	Pooled Holes	0	
3	9/8/2008	Targeted	Pooled Holes	0	
3	9/8/2008	Targeted	Pooled Holes	0	
3	9/8/2008	Targeted	Pooled Holes	0	
3	9/15/2008	Targeted	Flooded Areas	0	
3	9/15/2008	Targeted	Panne	0	flooded with wind blowing
3	9/15/2008	Targeted	Panne	0	
3	9/15/2008	Targeted	Pond	0	
3	9/15/2008	Targeted	Pond	0	
3	9/15/2008	Targeted	Pooled Holes	2	
3	9/15/2008	Targeted	Pooled Holes	0	path
3	9/15/2008	Targeted	Pooled Holes	0	
3	9/15/2008	Targeted	Pooled Holes	0	fish
3	9/15/2008	Targeted	Pooled Holes	0	
3	9/15/2008	Targeted	Pooled Holes	0	
3	9/15/2008	Targeted	Pooled Holes	0	
3	9/15/2008	Targeted	Pooled Holes	0	
3	9/15/2008	Targeted	Pooled Holes	0	
3	9/15/2008	Targeted	Pooled Holes	0	
3	9/15/2008	Targeted	Pooled Holes	0	
3	9/15/2008	Targeted	Pooled Holes	0	
3	9/15/2008	Targeted	Pooled Holes	0	
3	9/15/2008	Targeted	Pooled Holes	0	
3	9/15/2008	Targeted	Pooled Holes	0	
4	5/6/2008	Targeted	Flooded Areas	1	
4	5/6/2008	Targeted	Flooded Areas	0	
4	5/6/2008	Targeted	Flooded Areas	0	
4	5/6/2008	Targeted	Flooded Areas	0	
4	5/6/2008	Targeted	Flooded Areas	0	
4	5/6/2008	Targeted	Flooded Areas	0	
4	5/6/2008	Targeted	Panne	1	
4	5/6/2008	Targeted	Panne	1	
4	5/6/2008	Targeted	Panne	0	
4	5/6/2008	Targeted	Panne	0	
4	5/6/2008	Targeted	Panne	0	
4	5/6/2008	Targeted	Panne	0	
4	5/6/2008	Targeted	Panne	0	
4	5/6/2008	Targeted	Panne	0	
4	5/6/2008	Targeted	Panne	0	
4	5/6/2008	Targeted	Panne	0	
4	5/6/2008	Targeted	Pooled Holes	1	
4	5/6/2008	Targeted	Pooled Holes	0	
4	5/6/2008	Targeted	Pooled Holes	0	
4	5/6/2008	Targeted	Pooled Holes	0	
4	5/6/2008	Targeted	Pooled Holes	0	

[illegible]

[illegible]

Area	Date	Station #	Condition	Total # Larvae	Comments
4	6/2/2008	Targeted	Pooled Holes	0	
4	6/2/2008	Targeted	Pooled Holes	0	
4	6/2/2008	Targeted	Pooled Holes	0	
4	6/2/2008	Targeted	Pooled Holes	0	
4	6/2/2008	Targeted	Pooled Holes	0	
4	6/2/2008	Targeted	Pooled Holes	0	
4	6/2/2008	Targeted	Pooled Holes	0	
4	6/2/2008	Targeted	Pooled Holes	0	
4	6/2/2008	Targeted	Pooled Holes	0	
4	6/2/2008	Targeted	Pooled Holes	0	
4	6/2/2008	Targeted	Pooled Holes	0	
4	6/2/2008	Targeted	Pooled Holes	0	
4	6/2/2008	Targeted	Pooled Holes	0	
4	6/2/2008	Targeted	Pooled Holes	0	
4	6/2/2008	Targeted	Pooled Holes	0	
4	6/2/2008	Targeted	Saturated Soil	0	
4	6/4/2008	Targeted	Pooled Holes	0	
4	6/6/2008	Targeted	Pooled Holes	0	
4	6/9/2008	4-- 0	Pooled Holes	0	
4	6/9/2008	4--1-- 160	Pooled Holes	0	
4	6/9/2008	4--1-- 140	Pooled Holes	0	
4	6/9/2008	4--1-- 120	Pooled Holes	0	
4	6/9/2008	4--1-- 100	Pooled Holes	0	
4	6/9/2008	4--1-- 80	Pooled Holes	0	
4	6/9/2008	4--1-- 60	Pooled Holes	0	
4	6/9/2008	4--1-- 40	Pooled Holes	0	
4	6/9/2008	4--1-- 20	Pooled Holes	0	
4	6/9/2008	4--2-- 0	Dry No Water	0	
4	6/9/2008	4--2-- 120	Dry No Water	0	
4	6/9/2008	4--2-- 100	Dry No Water	0	
4	6/9/2008	4--2-- 80	Dry No Water	0	
4	6/9/2008	4--2-- 40	Panne	0	no stake
4	6/9/2008	4--2-- 160	Panne	0	
4	6/9/2008	4--2-- 140	Panne	0	
4	6/9/2008	4--2-- 60	Panne	0	
4	6/9/2008	4--2-- 20	Panne	0	
4	6/9/2008	4--3-- 120	Dry No Water	0	
4	6/9/2008	4--3-- 140	Dry No Water	0	
4	6/9/2008	4--3-- 60	Dry No Water	0	
4	6/9/2008	4--3-- 160	Pond	0	
4	6/9/2008	4--3-- 80	Pooled Holes	0	
4	6/9/2008	4--3-- 100	Pooled Holes	0	
4	6/9/2008	4--3-- 40	Pooled Holes	0	
4	6/9/2008	4--3-- 20	Pooled Holes	0	
4	6/9/2008	4--3-- 0	Pooled Holes	0	
4	6/9/2008	4--4-- 100	Ditch	0	
4	6/9/2008	4--4-- 0	Flooded Areas	0	
4	6/9/2008	4--4-- 160	Flooded Areas	0	
4	6/9/2008	4--4-- 60	Pooled Holes	0	
4	6/9/2008	4--4-- 120	Pooled Holes	0	
4	6/9/2008	4--4-- 80	Pooled Holes	0	
4	6/9/2008	4--4-- 140	Pooled Holes	0	
4	6/9/2008	4--4-- 20	Saturated Soil	0	
4	6/9/2008	4--4-- 40	Saturated Soil	0	
4	6/9/2008	Targeted	Dry No Water	0	
4	6/9/2008	Targeted	Flooded Areas	0	
4	6/9/2008	Targeted	Panne	1	
4	6/9/2008	Targeted	Panne	0	
4	6/9/2008	Targeted	Panne	0	
4	6/9/2008	Targeted	Panne	0	
4	6/9/2008	Targeted	Panne	0	
4	6/9/2008	Targeted	Panne	0	
4	6/9/2008	Targeted	Panne	0	
4	6/9/2008	Targeted	Panne	0	
4	6/9/2008	Targeted	Panne	0	
4	6/9/2008	Targeted	Pooled Holes	0	



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Area	Date	Station #	Condition	Total # Larvae	Comments
4	6/23/2008	Targeted	Pooled Holes	1	
4	6/23/2008	Targeted	Pooled Holes	1	
4	6/23/2008	Targeted	Pooled Holes	1	
4	6/23/2008	Targeted	Pooled Holes	0	
4	6/23/2008	Targeted	Pooled Holes	0	
4	6/23/2008	Targeted	Pooled Holes	0	
4	6/23/2008	Targeted	Pooled Holes	0	
4	6/23/2008	Targeted	Saturated Soil	0	
4	6/30/2008	Targeted	Flooded Areas	1	
4	6/30/2008	Targeted	Flooded Areas	1	
4	6/30/2008	Targeted	Flooded Areas	0	
4	6/30/2008	Targeted	Flooded Areas	0	
4	6/30/2008	Targeted	Flooded Areas	0	
4	6/30/2008	Targeted	Flooded Areas	0	
4	6/30/2008	Targeted	Flooded Areas	0	
4	6/30/2008	Targeted	Flooded Areas	0	
4	6/30/2008	Targeted	Flooded Areas	0	
4	6/30/2008	Targeted	Flooded Areas	0	
4	6/30/2008	Targeted	Flooded Areas	0	
4	6/30/2008	Targeted	Panne	0	
4	6/30/2008	Targeted	Panne	0	
4	6/30/2008	Targeted	Panne	0	
4	6/30/2008	Targeted	Panne	0	
4	6/30/2008	Targeted	Panne	0	
4	6/30/2008	Targeted	Panne	0	
4	6/30/2008	Targeted	Panne	0	
4	6/30/2008	Targeted	Panne	0	
4	6/30/2008	Targeted	Panne	0	
4	6/30/2008	Targeted	Panne	0	
4	6/30/2008	Targeted	Panne	0	
4	6/30/2008	Targeted	Panne	0	
4	6/30/2008	Targeted	Panne	0	
4	6/30/2008	Targeted	Panne	0	
4	7/2/2008	Targeted	Pooled Holes	0	\$GPGGA,,,,,0,,,,,,,,*66
4	7/8/2008	4-1-- 100	Dry No Water	0	
4	7/8/2008	4-1-- 80	Dry No Water	0	
4	7/8/2008	4-1-- 140	Dry No Water	0	
4	7/8/2008	4-1-- 0	Dry No Water	0	
4	7/8/2008	4-1-- 20	Dry No Water	0	
4	7/8/2008	4-1--120	Panne	0	
4	7/8/2008	4-1-- 160	Pooled Holes	0	
4	7/8/2008	4-1-- 60	Pooled Holes	0	
4	7/8/2008	4-1-- 40	Pooled Holes	0	
4	7/8/2008	4-2-- 20	Dry No Water	0	
4	7/8/2008	4-2--160	Dry No Water	0	
4	7/8/2008	4-2-- 140	Dry No Water	0	
4	7/8/2008	4-2-- 120	Dry No Water	0	
4	7/8/2008	4-2--100	Dry No Water	0	
4	7/8/2008	4-2-- 80	Dry No Water	0	
4	7/8/2008	4-2-- 60	Dry No Water	0	
4	7/8/2008	4-2-- 40	Dry No Water	0	
4	7/8/2008	4-2-- 0	Dry No Water	0	
4	7/8/2008	4-3--120	Ditch	0	
4	7/8/2008	4-3-- 60	Dry No Water	0	
4	7/8/2008	4-3-- 140	Dry No Water	0	
4	7/8/2008	4-3-- 160	Pond	0	inverts
4	7/8/2008	4-3--100	Pooled Holes	1	
4	7/8/2008	4-3-- 0	Pooled Holes	1	
4	7/8/2008	4-3-- 20	Pooled Holes	1	
4	7/8/2008	4-3-- 80	Pooled Holes	0	
4	7/8/2008	4-3-- 40	Saturated Soil	0	
4	7/8/2008	4-4-- 100	Ditch	0	

Area	Date	Station #	Condition	Total # Larvae	Comments
4	7/8/2008	4.-4.- 60	Panne	5	
4	7/8/2008	4.-4.- 80	Panne	0	gps correct ? fish
4	7/8/2008	4.-4.- 120	Saturated Soil	0	
4	7/8/2008	4.-4.- 140	Saturated Soil	0	
4	7/8/2008	4.-4.- 20	Saturated Soil	0	
4	7/8/2008	4.-4.- 0	Saturated Soil	0	
4	7/8/2008	4.-4.- 40	Saturated Soil	0	fish
4	7/8/2008	4.-4.- 160	Saturated Soil	0	
4	7/8/2008	Targeted	Dry No Water	0	
4	7/8/2008	Targeted	Panne	2	
4	7/8/2008	Targeted	Panne	1	
4	7/8/2008	Targeted	Panne	1	
4	7/8/2008	Targeted	Panne	0	
4	7/8/2008	Targeted	Panne	0	
4	7/8/2008	Targeted	Panne	0	
4	7/8/2008	Targeted	Panne	0	
4	7/8/2008	Targeted	Panne	0	
4	7/8/2008	Targeted	Pooled Holes	2	
4	7/8/2008	Targeted	Pooled Holes	2	
4	7/8/2008	Targeted	Pooled Holes	2	
4	7/8/2008	Targeted	Pooled Holes	1	
4	7/8/2008	Targeted	Pooled Holes	0	
4	7/8/2008	Targeted	Pooled Holes	0	
4	7/8/2008	Targeted	Pooled Holes	0	
4	7/8/2008	Targeted	Pooled Holes	0	
4	7/8/2008	Targeted	Pooled Holes	0	
4	7/8/2008	Targeted	Pooled Holes	0	
4	7/8/2008	Targeted	Pooled Holes	0	
4	7/8/2008	Targeted	Pooled Holes	0	dead pupae
4	7/14/2008	Targeted	Ditch	0	
4	7/14/2008	Targeted	Dry No Water	0	
4	7/14/2008	Targeted	Dry No Water	0	
4	7/14/2008	Targeted	Dry No Water	0	
4	7/14/2008	Targeted	Dry No Water	0	
4	7/14/2008	Targeted	Dry No Water	0	
4	7/14/2008	Targeted	Dry No Water	0	
4	7/14/2008	Targeted	Dry No Water	0	
4	7/14/2008	Targeted	Dry No Water	0	
4	7/14/2008	Targeted	Pooled Holes	0	
4	7/14/2008	Targeted	Pooled Holes	0	
4	7/14/2008	Targeted	Pooled Holes	0	
4	7/14/2008	Targeted	Pooled Holes	0	H2O off ditch
4	7/14/2008	Targeted	Pooled Holes	0	
4	7/14/2008	Targeted	Pooled Holes	0	typically is panne; internal ditch
4	7/14/2008	Targeted	Pooled Holes	0	
4	7/14/2008	Targeted	Pooled Holes	0	
4	7/14/2008	Targeted	Saturated Soil	0	
4	7/14/2008	Targeted	Saturated Soil	0	
4	7/14/2008	Targeted	Saturated Soil	0	usually a panne
4	7/14/2008	Targeted	Saturated Soil	0	
4	7/14/2008	Targeted	Saturated Soil	0	usually a panne
4	7/21/2008	Targeted	Panne	0	
4	7/21/2008	Targeted	Panne	0	
4	7/21/2008	Targeted	Panne	0	
4	7/21/2008	Targeted	Panne	0	
4	7/21/2008	Targeted	Panne	0	
4	7/21/2008	Targeted	Panne	0	
4	7/21/2008	Targeted	Pooled Holes	41	
4	7/21/2008	Targeted	Pooled Holes	33	
4	7/21/2008	Targeted	Pooled Holes	27	
4	7/21/2008	Targeted	Pooled Holes	10	
4	7/21/2008	Targeted	Pooled Holes	3	
4	7/21/2008	Targeted	Pooled Holes	2	
4	7/21/2008	Targeted	Pooled Holes	2	

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**Wertheim NWR Water Management Demonstration Project Data Report**  
**Mosquito Larvae**  
**2008**

Area	Date	Station #	Condition	Total # Larvae	Comments
4	8/25/2008	Targeted	Pooled Holes	0	
4	8/25/2008	Targeted	Pooled Holes	0	
4	8/25/2008	Targeted	Pooled Holes	0	
4	9/2/2008	Targeted	Ditch	0	
4	9/3/2008	Targeted	Dry No Water	0	
4	9/3/2008	Targeted	Dry No Water	0	
4	9/3/2008	Targeted	Dry No Water	0	
4	9/3/2008	Targeted	Panne	3	
4	9/3/2008	Targeted	Panne	2	
4	9/3/2008	Targeted	Panne	0	
4	9/3/2008	Targeted	Panne	0	
4	9/3/2008	Targeted	Panne	0	
4	9/3/2008	Targeted	Pooled Holes	19	
4	9/3/2008	Targeted	Pooled Holes	14	
4	9/3/2008	Targeted	Pooled Holes	5	
4	9/3/2008	Targeted	Pooled Holes	5	
4	9/3/2008	Targeted	Pooled Holes	5	
4	9/3/2008	Targeted	Pooled Holes	4	
4	9/3/2008	Targeted	Pooled Holes	4	
4	9/3/2008	Targeted	Pooled Holes	3	
4	9/3/2008	Targeted	Pooled Holes	2	
4	9/3/2008	Targeted	Pooled Holes	1	
4	9/3/2008	Targeted	Pooled Holes	0	
4	9/3/2008	Targeted	Pooled Holes	0	
4	9/3/2008	Targeted	Pooled Holes	0	
4	9/3/2008	Targeted	Pooled Holes	0	
4	9/3/2008	Targeted	Pooled Holes	0	
4	9/3/2008	Targeted	Pooled Holes	0	
4	9/3/2008	Targeted	Pooled Holes	0	
4	9/3/2008	Targeted	Pooled Holes	0	
4	9/3/2008	Targeted	Pooled Holes	0	
4	9/3/2008	Targeted	Pooled Holes	0	
4	9/8/2008	4--1-- 20	Dry No Water	0	
4	9/8/2008	4--1-- 160	Dry No Water	0	
4	9/8/2008	4--1--100	Dry No Water	0	
4	9/8/2008	4--1-- 60	Panne	1	
4	9/8/2008	4--1-- 140	Panne	0	
4	9/8/2008	4--1-- 80	Panne	0	
4	9/8/2008	4--1-- 120	Panne	0	
4	9/8/2008	4--1-- 40	Panne	0	
4	9/8/2008	4--1-- 0	Saturated Soil	0	
4	9/8/2008	4--2-- 20	Dry No Water	0	
4	9/8/2008	4--2-- 80	Dry No Water	0	
4	9/8/2008	4--2-- 100	Dry No Water	0	
4	9/8/2008	4--2-- 0	Dry No Water	0	
4	9/8/2008	4--2-- 40	Dry No Water	0	
4	9/8/2008	4--2-- 60	Dry No Water	0	
4	9/8/2008	4--2--120	Dry No Water	0	
4	9/8/2008	4--2-- 140	Dry No Water	0	
4	9/8/2008	4--2--160	Pooled Holes	0	
4	9/8/2008	4--3--120	Ditch	0	
4	9/8/2008	4--3-- 140	Dry No Water	0	
4	9/8/2008	4--3-- 60	Dry No Water	0	
4	9/8/2008	4--3-- 40	Panne	0	
4	9/8/2008	4--3--160	Pond	0	
4	9/8/2008	4--3-- 0	Pooled Holes	1	
4	9/8/2008	4--3-- 100	Pooled Holes	0	
4	9/8/2008	4--3-- 80	Pooled Holes	0	
4	9/8/2008	4--3-- 20	Pooled Holes	0	
4	9/8/2008	4--4-- 100	Ditch	0	
4	9/8/2008	4--4-- 40	Flooded Areas	0	
4	9/8/2008	4--4-- 60	Panne	0	dead pupae & skins
4	9/8/2008	4--4-- 140	Pooled Holes	0	
4	9/8/2008	4--4-- 0	Pooled Holes	0	
4	9/8/2008	4--4-- 120	Pooled Holes	0	
4	9/8/2008	4--4-- 80	Pooled Holes	0	

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## **Appendix F**

### **Nekton Sampling 2008**





Wertheim NWR Water Management Demonstration Project Data Report  
Nekton Sampling  
2008

Date	Station	Water Depth (cm)	Creek Depth (cm)	Tide	Habitat	Area (m^2)	Water Temp (C)	Salinity (ppt)	DO (mg/L)	Anguilla rostrata		Aplodes quadracus		Callinectes sapidus		Cymatodon variegatus		Fundulus diaphanus		Fundulus heteroclitus		Fundulus luciae		Lucania parva		Menidia spp.		Uca spp.		Palaeomonetes spp.		Unknown killifish		Unknown	
										Total #	Avg. Size (mm)	Total #	Avg. Size (mm)	Total #	Avg. Size (mm)	Total #	Avg. Size (mm)	Total #	Avg. Size (mm)	Total #	Avg. Size (mm)	Total #	Avg. Size (mm)	Total #	Avg. Size (mm)	Total #	Avg. Size (mm)	Total #	Avg. Size (mm)	Total #	Avg. Size (mm)	Total #	Avg. Size (mm)	Total #	Avg. Size (mm)
Area 1																																			
6/20/2008	D-1	71.9	74.0	Flood	Tidal Creek	0.794	24.0	3.2	7.55																										
6/20/2008	D-3	12.5	12.5	Flood	Tidal Creek	0.648	22.4	8.4	8.50								1	16.0			6	25.7	1	26.0								2	20.0		
6/20/2008	D-5	51.0	55.0	Flood	Tidal Creek	0.943	23.8	6.5	8.00																										
6/20/2008	TC-1	31.0	40.0	Flood	Tidal Creek	0.789	23.6	8.3	7.90								1	17.0			3	22.7													
6/20/2008	TC-2	47.0	48.0	Flood	Tidal Creek	0.984	23.0	6.9	5.50											9	61.3			2	75.0										
6/20/2008	TC-3	36.0	39.0	Flood	Tidal Creek	0.721	23.1	8.0	5.30										1	25.0															
6/20/2008	TC-4	29.0	29.0	Flood	Tidal Creek	0.568	23.7	11.9	1.80																										
6/20/2008	P1-4-A	32.0		Flood	Pond	1.000	27.3	3.3	5.90								1	28.0			3	20.3													
6/20/2008	P1-6-A	31.3		Flood	Pond	1.000	24.4	13.6	4.60	3	60.3																								
6/20/2008	P1-8-B	17.0		Flood	Pond	1.000	27.0	10.5	3.04	1	65.0								5	16.5*												1	10.0		
8/12/2008	D-1	43.0	56.0	Flood	Tidal Creek	0.857	20.5	3.3	2.54								3	31.0			3	29.3			3	20.0					1	----			
8/12/2008	D-3	19.0	26.0	Flood	Tidal Creek	0.695	18.3	5.4	0.33												1	28.0													
8/12/2008	D-5	36.0	41.0	Flood	Tidal Creek	0.960	21.6	4.7	2.18								27	29.5			67	49.9					1	29.0							
8/12/2008	TC-1	27.2	44.2	Flood	Tidal Creek	0.639	21.5	6.7	4.03																										
8/12/2008	TC-2	36.8	43.8	Flood	Tidal Creek	0.837	20.8	6.1	2.48								2	27.0																	
8/12/2008	TC-3	39.0	50.0	Flood	Tidal Creek	0.551	20.2	11.2	0.58												5	19.0													
8/12/2008	TC-4	24.0	39.5	Flood	Tidal Creek	0.514	20.0	4.1	0.82												23	20.9													
8/12/2008	P1-4-A	28.0		Flood	Pond	1.000	21.7	10.3	2.50											5	28.8	1	32.0												
8/12/2008	P1-6-A	34.0		Flood	Pond	1.000	21.5	13.4	1.57								5	27.2																	
8/12/2008	P1-8-B	10.0		Flood	Pond	1.000	19.9	7.5	2.10	1	65.0						2	21.5			23	27.0					3	25.0							
10/7/2008	D-1	11.0	54.0	Ebb	Tidal Creek	0.814	12.0	2.9	16.30																										
10/7/2008	D-3	10.0	56.0	Ebb	Tidal Creek	0.652	13.2	6.1	5.80																										
10/7/2008	D-5	12.0	35.0	Ebb	Tidal Creek	0.678	12.6	7.1	2.30																										
10/7/2008	TC-1	6.0	36.0	Ebb	Tidal Creek	0.379	19.0	2.4	6.80																										
10/7/2008	TC-2	7.0	32.0	Ebb	Tidal Creek	0.459	16.9	4.3	5.60								12	35.2			65	49.3													
10/7/2008	TC-3	9.0	26.0	Ebb	Tidal Creek	0.588	14.5	13.8	2.80																										
10/7/2008	TC-4	10.0	18.0	Ebb	Tidal Creek	0.345	14.6	12.7	1.90												3	13.0													
10/7/2008	P1-4-A	23.8		Ebb	Pond	1.000	15.9	13.1	3.70								5	27.4			9	30.6*													
10/7/2008	P1-6-A	31.9		Ebb	Pond	1.000	13.1	18.8	6.12	1	120.0						20	33.7			23	42.2			2	25.0*									
10/7/2008	P1-8-B	20.7		Ebb	Pond	1.000	11.6	10.4	9.70												1	30.0													

Wertheim NWR Water Management Demonstration Project Data Report  
Nekton Sampling  
2008

Date	Station	Water Depth (cm)	Creek Depth (cm)	Tide	Habitat	Area (m^2)	Water Temp (C)	Salinity (ppt)	DO (mg/L)	Anguilla rostrata		Aplodes quadracus		Callinectes sapidus		Cyprinodon variegatus		Fundulus diaphanus		Fundulus heteroclitus		Fundulus luciae		Lucania parva		Menidia spp.		Uca spp.		Palaeomonetes spp.		Unknown killifish		Unknown		
										Total #	Avg. Size (mm)	Total #	Avg. Size (mm)	Total #	Avg. Size (mm)	Total #	Avg. Size (mm)	Total #	Avg. Size (mm)	Total #	Avg. Size (mm)	Total #	Avg. Size (mm)	Total #	Avg. Size (mm)	Total #	Avg. Size (mm)	Total #	Avg. Size (mm)	Total #	Avg. Size (mm)	Total #	Avg. Size (mm)	Total #	Avg. Size (mm)	Total #
Area 2																																				
6/18/2008	D-1	72.0	80.0	Flood	Tidal Creek	0.612	23.8	8.5	6.60											1	19.0															
6/18/2008	D-2	81.0	81.0	Flood	Tidal Creek	1.192	24.0	11.1	4.70																											
6/18/2008	D-8	35.5	35.5	Flood	Filled Ditch	0.386	24.1	13.7	8.50					1	----					1	74.0						3	31.3								
6/18/2008	TC-1	NM	NM	Flood	Tidal Creek	0.722	NM	NM	NM																											
6/18/2008	TC-2	86.0	86.0	Flood	Tidal Creek	0.500	24.9	15.4	8.40											2	36.0			1	45.0											
6/18/2008	TC-3	58.0	105.0	Flood	Tidal Creek	0.798	22.2	11.5	6.10															1	22.0											
6/18/2008	P2-3-B	NM		Flood	Pond	1	25.8	14.0	6.20					1	30.0					1	58.0													3	11.7	
6/18/2008	P2-5-A	41.0		Flood	Pond	1	24.0	15.6	7.50	1	65.0									4	55.8															
6/18/2008	P2-6-A	38.0		Flood	Pond	1	23.6	14.9	12.30																								1	----		
8/13/2008	D-1	43.0	63.0	Flood	Tidal Creek	1.338	22.2	5.8	0.40											1	22.0															
8/13/2008	D-2	66.5	81.5	Flood	Tidal Creek	1.014	23.4	8.6	2.50										1	34.0	11	29.7				40	35.7									
8/13/2008	D-8	31.0	37.0	Flood	Filled Ditch	0.689	22.4	8.2	5.20															4	18.0									1	----	
8/13/2008	TC-1	31.5	44.5	Flood	Tidal Creek	0.811	20.4	10.0	0.48											2	23.5															
8/13/2008	TC-2	47.0	50.0	Flood	Tidal Creek	0.509	21.6	6.3	0.16																	14	33.4									
8/13/2008	TC-3	28.0	47.0	Flood	Tidal Creek	0.787	23.8	7.9	2.80								1	28.0			11	32.1														
8/13/2008	P2-3-B	62.0		Flood	Pond	1	27.5	11.7	1.40																											
8/13/2008	P2-5-A	18.5		Flood	Pond	1	24.8	13.4	7.50								18	28.9		13	25.2			3	20.0											
8/13/2008	P2-6-A	27.0		Flood	Pond	1	26.1	13.0	7.10								8	27.0		26	32.3			1	25.0	2	21.5						1	22.0		
10/8/2008	D-1	37.5	73.0	Ebb	Tidal Creek	0.773	13.8	3.4	1.80											4	33.0															
10/8/2008	D-2	46.0	93.0	Ebb	Tidal Creek	0.749	13.2	9.4	1.10																											
10/8/2008	D-8	NM	NM	Ebb	Filled Ditch	0.882	16.9	7.8	2.65					1	19.0																					
10/8/2008	TC-1	30.5	53.0	Ebb	Tidal Creek	0.606	15.7	12.0	0.60																											
10/8/2008	TC-2	20.0	43.0	Ebb	Tidal Creek	0.828	14.3	12.4	1.20																											
10/8/2008	TC-3	15.0	25.0	Ebb	Tidal Creek	0.826	18.9	8.6	0.40																											
10/8/2008	P2-3-B	37.0		Ebb	Pond	1	12.7	14.6	0.65																											
10/8/2008	P2-5-A	31.0		Ebb	Pond	1	14.3	16.4	6.30								3	38.0		3	27.7															
10/8/2008	P2-6-A	20.0		Ebb	Pond	1	14.0	17.6	6.80																								2	25.0		

Wertheim NWR Water Management Demonstration Project Data Report  
Nekton Sampling  
2008

Date	Station	Water Depth (cm)	Creek Depth (cm)	Tide	Habitat	Area (m^2)	Water Temp (C)	Salinity (ppt)	D.O (mg/L)	Anguilla rostrata		Apoeltes quadracus		Gallinectes sapidus		Cyprinodon variegatus		Fundulus diaphanus		Fundulus heteroclitus		Fundulus luciae		Lucania parva		Menidia spp.		Uta spp.		Palaemonetes spp.		Unknown killifish		Unknown	
										Total #	Avg. Size (mm)	Total #	Avg. Size (mm)	Total #	Avg. Size (mm)	Total #	Avg. Size (mm)	Total #	Avg. Size (mm)	Total #	Avg. Size (mm)	Total #	Avg. Size (mm)	Total #	Avg. Size (mm)	Total #	Avg. Size (mm)	Total #	Avg. Size (mm)	Total #	Avg. Size (mm)	Total #	Avg. Size (mm)	Total #	Avg. Size (mm)
Area 3																																			
6/17/2008	D-1	14.0	20.0	Flood	Plugged Ditch	0.715	27.0	8.6	0.20																										
6/17/2008	D-2	57.0	57.0	Flood	Plugged Ditch	0.679	27.3	9.3	5.50											5	31.3														
6/17/2008	D-3	10.0	10.0	Flood	Plugged Ditch	0.549	22.8	9.2	0.43											1	30.0														
6/17/2008	D-4	8.0	22.0	Flood	Plugged Ditch	0.564	27.4	6.8	1.03																										
6/17/2008	D-5	42.0	42.0	Flood	Plugged Ditch	0.543	24.1	7.7	5.30	1	----									3	21.0													1.0	----
6/17/2008	D-6	37.0	40.0	Flood	Plugged Ditch	0.910	26.0	10.4	0.72											3	16.3														
6/17/2008	D-7	30.5	30.5	Flood	Plugged Ditch	0.910	23.1	14.3	2.20											8	18.8									6.0	16.2				
6/17/2008	D-8	27.2	27.2	Flood	Plugged Ditch	0.496	23.7	12.1	5.60			2	30.0							17	19.5									1.0	13.0				
6/17/2008	D-9	28.0	28.0	Flood	Plugged Ditch	0.591	22.7	12.7	0.90																										
6/17/2008	D-10	39.8	39.8	Flood	Plugged Ditch	0.746	24.1	18.2	5.00							1	13.0			5	18.4														
8/13/2008	D-1	19.0	21.0	Ebb	Plugged Ditch	0.641	30.5	0.1	0.10																										
8/13/2008	D-2	18.0	18.0	Ebb	Plugged Ditch	0.699	22.7	0.3	0.70								1	13.0			13	20.8													
8/13/2008	D-3	Dry	Dry	Ebb	Plugged Ditch																														
8/13/2008	D-4	Dry	Dry	Ebb	Plugged Ditch																														
8/13/2008	D-5	NM	NM	Ebb	Plugged Ditch	0.718	22.7	8.3	0.27											1	24.0														
8/13/2008	D-6	NM	NM	Ebb	Plugged Ditch	0.494	25.8	11.6	0.17											60	24.3														
8/13/2008	D-7	16.0	31.0	Ebb	Plugged Ditch	0.474	28.0	12.0	0.06																										
8/13/2008	D-8	12.0	12.0	Ebb	Plugged Ditch		25.0	12.4	0.26											1	35.0														
8/13/2008	D-9	18.0	18.0	Ebb	Plugged Ditch	0.390	28.0	11.6	0.23																										
8/13/2008	D-10	14.0	14.0	Ebb	Plugged Ditch	0.724	26.0	16.3	10.50											5	26.2			3	22.0										
10/10/2008	D-1	21.0	22.0	Ebb	Plugged Ditch	0.726	20.6	8.4	1.00															7	25.9										
10/10/2008	D-2	14.0	26.0	Ebb	Plugged Ditch	0.528	21.5	9.4	0.80																										
10/10/2008	D-3	9.0	10.0	Ebb	Plugged Ditch	0.629	14.5	9.5	1.30																										
10/10/2008	D-4	8.5	9.0	Ebb	Plugged Ditch	0.746	23.0	10.6	6.00																										
10/10/2008	D-5	26.0	53.0	Ebb	Plugged Ditch	0.301	16.4	10.3	0.40																										
10/10/2008	D-6	20.0	43.0	Ebb	Plugged Ditch	0.820	15.6	14.9	0.70											2	32.0														
10/10/2008	D-7	41.0	44.0	Ebb	Plugged Ditch	0.709	14.5	7.7	0.30											5	30.6														
10/10/2008	D-8	28.0	48.0	Ebb	Plugged Ditch	0.444	14.2	6.7	0.20																										
10/10/2008	D-9	25.0	31.0	Ebb	Plugged Ditch	0.498	15.4	6.5	0.24																										
10/10/2008	D-10	52.0	54.0	Ebb	Plugged Ditch	0.729	17.0	18.4	3.40								37	40.1			15	38.0			3	32.0					43	28.2			

Wertheim NWR Water Management Demonstration Project Data Report  
Nekton Sampling  
2008

Date	Station	Water Depth (cm)	Creek Depth (cm)	Tide	Habitat	Area (m^2)	Water Temp (C)	Salinity (ppt)	DO (mg/L)	Anguilla rostrata		Apletes quadracus		Callinectes sapidus		Cyprinodon variegatus		Fundulus diaphanus		Fundulus heteroclitus		Fundulus luciae		Lucania parva		Menidia spp.		Uca spp.		Palaeomonetes spp.		Unknown killifish		Unknown	
										Total #	Avg. Size (mm)	Total #	Avg. Size (mm)	Total #	Avg. Size (mm)	Total #	Avg. Size (mm)	Total #	Avg. Size (mm)	Total #	Avg. Size (mm)	Total #	Avg. Size (mm)	Total #	Avg. Size (mm)	Total #	Avg. Size (mm)	Total #	Avg. Size (mm)	Total #	Avg. Size (mm)	Total #	Avg. Size (mm)	Total #	Avg. Size (mm)
Area 4																																			
6/19/2008	D-1	15.0	15.0	Flood	Plugged Ditch	0.491	22.9	7.7	0.25																										
6/19/2008	D-2	18.0	18.0	Flood	Plugged Ditch	0.576	19.9	16.4	0.27																										
6/19/2008	D-3	110.0	115.0	Flood	Plugged Ditch	0.738	21.6	14.5	5.02																	1	65.0								
6/19/2008	D-4	39.5	40.0	Flood	Plugged Ditch	0.739	20.9	11.9	2.70											3	55.0	5	36.0	3	36.0										
6/19/2008	D-5	30.0	30.0	Flood	Plugged Ditch	0.632	24.1	11.6	5.50	1	50.0								3	44.7	2	32.0													
6/19/2008	D-6	28.0	28.0	Flood	Plugged Ditch	0.738	24.2	5.6	0.60										1	29.0															
6/19/2008	D-7	24.0	29.0	Flood	Plugged Ditch	0.608	23.8	1.2	1.00																										
6/19/2008	D-8	29.0	29.0	Flood	Plugged Ditch	0.619	28.5	1.8	5.70																1	66.0									
6/19/2008	D-9	22.0	22.0	Flood	Plugged Ditch	0.857	25.9	19.5	5.30																										
6/19/2008	D-10	39.0	39.0	Flood	Plugged Ditch	0.825	23.8	15.6	7.50																										
8/14/2008	D-1	9.0	22.0	Flood	Plugged Ditch	0.433	21.0	18.3	0.56											12	14.2														
8/14/2008	D-2	25.0	42.0	Flood	Plugged Ditch	0.560	21.0	12.7	0.85											1	16.0														
8/14/2008	D-3	86.0	86.0	Flood	Plugged Ditch	0.577	23.1	7.5	1.40											2	22.0														
8/14/2008	D-4	30.0	30.0	Flood	Plugged Ditch	0.380	20.7	5.4	1.30																1	29.0									
8/14/2008	D-5	14.0	14.0	Flood	Plugged Ditch	0.626	22.0	2.7	2.80											4	28.3				1	24.0									
8/14/2008	D-6	21.0	24.0	Flood	Plugged Ditch	0.796	23.7	1.3	4.20											22	22.0														
8/14/2008	D-7	13.0	27.5	Flood	Plugged Ditch	0.735	22.0	0.5	1.10											5	24.0			4	17.0										
8/14/2008	D-8	17.0	27.0	Flood	Plugged Ditch	0.793	24.4	0.7	3.60											29	25.3			4	20.3										
8/14/2008	D-9	13.0	13.0	Flood	Plugged Ditch	0.480	22.0	20.3	0.75											26	18.1							1	19.0						
8/14/2008	D-10	29.0	38.0	Flood	Plugged Ditch	0.825	22.0	10.7	1.06											1	25.0														
10/7/2008	D-1	20.5	35.0	Flood	Plugged Ditch	0.361	17.7	19.6	5.60																										
10/7/2008	D-2	21.5	37.0	Flood	Plugged Ditch	0.555	13.7	15.2	1.40											4	27.0														
10/7/2008	D-3	86.0	100.0	Flood	Plugged Ditch	0.613	14.8	5.6	14.50																										
10/7/2008	D-4	16.0	34.0	Flood	Plugged Ditch	0.476	16.3	12.4	0.75															1	26.0			1	----						
10/7/2008	D-5	10.0	15.0	Flood	Plugged Ditch	0.580	17.1	4.4	2.10											2	16.5														
10/7/2008	D-6	19.0	23.0	Flood	Plugged Ditch	0.670	17.4	3.0	3.30											1	40.0														
10/7/2008	D-7	15.0	21.0	Flood	Plugged Ditch	0.507	17.6	0.9	2.70																										
10/7/2008	D-8	30.0	100.0	Flood	Plugged Ditch	0.691	19.8	8.7	7.40											3	22.3			1	17.0			1	24.0						
10/7/2008	D-9	22.0	22.0	Flood	Plugged Ditch	0.463	19.2	8.4	8.20																										
10/7/2008	D-10	16.0	18.0	Flood	Plugged Ditch	0.701	18.7	11.3	1.90																										

## **Appendix G**

### **Bird Survey 2008**





## Wertheim HWR Water Management Demonstration Project Data Report

**Bird Survey  
2008**

Date	Area	Observer	Point	Fixed Pt Walking	Species Scientific	Species Common	Guild	Alpha Code	Total Count (Excl. Fly)	Total Fly Over	0-50 meters						50-100 meters						>100 meters						Fly Over		
											0-3 min s h s	3-5 min h s h	5-10 min s h s	0-3 min s h s	3-5 min h s h	5-10 min s h s	0-3 min s h s	3-5 min h s h	5-10 min s h s	0-3 min s h s	3-5 min h s h	5-10 min s h s	0-40 min s h s	40-60 min h s h							
2/21/2008	1	TLJ/F	0-1	WV	none				0	0																					
2/21/2008	1	TLJ/F	1	F	<i>Agelaius phoeniceus</i>	Red-Winged Blackbird	Passerine	RWBL	0	1																			1		
2/21/2008	1	TLJ/F	1	F	<i>Larus argentatus</i>	Herring Gull	HERG	0	2																				2		
2/21/2008	1	TLJ/F	1 - 2	WV	Unidentified sparrow	Unknown Sparrow	Passerine	UNSP	1	0	1																				
2/21/2008	1	TLJ/F	2	F	Unidentified sparrow	Unknown Sparrow	Passerine	UNSP	2	0							2														
2/21/2008	1	TLJ/F	2-3	WV	none				0	0																					
2/21/2008	1	TLJ/F	3	F	Unidentified sparrow	Unknown Sparrow	Passerine	UNSP	2	0							2														
2/21/2008	1	TLJ/F	3	F	<i>Branta canadensis</i>	Canada Goose	Waterfowl	CAGO	1	0							1														
2/21/2008	1	TLJ/F	3	F	<i>Agelaius phoeniceus</i>	Red-Winged Blackbird	Passerine	RWBL	10	0																		10			
2/21/2008	1	TLJ/F	3-4	WV	none				0	0																					
2/21/2008	1	TLJ/F	4	F	<i>Branta canadensis</i>	Canada Goose	Waterfowl	CAGO	1	0																					1
2/21/2008	1	TLJ/F	4-5	WV	none				0	0																					
2/21/2008	1	TLJ/F	5	F	<i>Haliaeetus leucocephalus</i>	Bald Eagle	Other	BAE A	0	1																					
2/21/2008	1	TLJ/F	5	F	<i>Anas rubripes</i>	American Black Duck	Waterfowl	ABDU	0	1																					1
2/21/2008	1	TLJ/F	5	F	Unidentified sparrow	Unknown Sparrow	Passerine	UNSP	2	0							2														1
2/21/2008	1	TLJ/F	5-10	WV	none				0	0																					
6/1/2008	1	TLJ/F	0-1	WV	<i>Cistothorus palustris</i>	Marsh Wren	Passerine	MAWR	1	0	1																				
6/1/2008	1	TLJ/F	0-1	WV	<i>Agelaius phoeniceus</i>	Red-Winged Blackbird	Passerine	RWBL	1	0	1																				
6/1/2008	1	TLJ/F	1	F	<i>Corvus brachyrhynchos</i>	American Crow	Passerine	AMCR	0	2																				2	
6/1/2008	1	TLJ/F	1	F	<i>Cistothorus palustris</i>	Marsh Wren	Passerine	MAWR	4	1		3	1																		1
6/1/2008	1	TLJ/F	1	F	<i>Agelaius phoeniceus</i>	Red-Winged Blackbird	Passerine	RWBL	2	0																					
6/1/2008	1	TLJ/F	1-2	WV	<i>Ammodramus caudatus</i>	Saltmarsh Sharp-Tailed Sparrow	Passerine	SSTS	0	0	1																				
6/1/2008	1	TLJ/F	2	F	<i>Corvus ossifragus</i>	Fish Crow	Passerine	FICR	0	0																					
6/1/2008	1	TLJ/F	2	F	<i>Ardea alba</i>	Great Egret	Wading	GREG	0	1																					
6/1/2008	1	TLJ/F	2	F	<i>Anas platyrhynchos</i>	Mallard	Waterfowl	MALL	2	1							2													1	
6/1/2008	1	TLJ/F	2	F	<i>Cistothorus palustris</i>	Marsh Wren	Passerine	MAWR	3	0							3														
6/1/2008	1	TLJ/F	2	F	<i>Agelaius phoeniceus</i>	Red-Winged Blackbird	Passerine	RWBL	2	0							2														
6/1/2008	1	TLJ/F	2	F	<i>Ammodramus caudatus</i>	Saltmarsh Sharp-Tailed Sparrow	Passerine	SSTS	1	0							1														
6/1/2008	1	TLJ/F	2	F	<i>Ammodramus maritimus</i>	Seaside Sparrow	Passerine	SESP	1	0							1														
6/1/2008	1	TLJ/F	2	F	<i>Egretta thula</i>	Snowy Egret	Wading	SNEG	1	0																					
6/1/2008	1	TLJ/F	2	F	<i>Tachycineta bicolor</i>	Tree Swallow	Passerine	TRSW	0	1																					1
6/1/2008	1	TLJ/F	2-3	WV	<i>Anas platyrhynchos</i>	Mallard	Waterfowl	MALL	1	0	1																				
6/1/2008	1	TLJ/F	2-3	WV	<i>Tachycineta bicolor</i>	Tree Swallow	Passerine	TRSW	1	0	1																				
6/1/2008	1	TLJ/F	3	F	<i>Falco sparverius</i>	American Kestrel	Other	AMKE	0	1																					
6/1/2008	1	TLJ/F	3	F	<i>Cistothorus palustris</i>	Marsh Wren	Passerine	MAWR	4	0																					1
6/1/2008	1	TLJ/F	3	F	<i>Pandion haliaetus</i>	Osprey	Other	OSPR	1	0																					
6/1/2008	1	TLJ/F	3	F	<i>Agelaius phoeniceus</i>	Red-Winged Blackbird	Passerine	RWBL	2	0							2														
6/1/2008	1	TLJ/F	3	F	<i>Tachycineta bicolor</i>	Tree Swallow	Passerine	TRSW	0	3																					3
6/1/2008	1	TLJ/F	3-4	WV	<i>Ardea alba</i>	Great Egret	Wading	GREG	0	1																					
6/1/2008	1	TLJ/F	3-4	WV	<i>Anas platyrhynchos</i>	Mallard	Waterfowl	MALL	2	0							2														
6/1/2008	1	TLJ/F	3-4	WV	<i>Agelaius phoeniceus</i>	Red-Winged Blackbird	Passerine	RWBL	1	0							1														
6/1/2008	1	TLJ/F	3-4	WV	Unidentified sparrow	Unknown Sparrow	Passerine	UNSP	1	0							1														
6/1/2008	1	TLJ/F	4	F	<i>Hirundo rustica</i>	Barn Swallow	Passerine	BARS	1	0																					
6/1/2008	1	TLJ/F	4	F	<i>Cistothorus palustris</i>	Marsh Wren	Passerine	MAWR	6	0							6														
6/1/2008	1	TLJ/F	4	F	<i>Agelaius phoeniceus</i>	Red-Winged Blackbird	Passerine	RWBL	1	0							1														
6/1/2008	1	TLJ/F	4	F	<i>Ammodramus caudatus</i>	Saltmarsh Sharp-Tailed Sparrow	Passerine	SSTS	1	0																					
6/1/2008	1	TLJ/F	4	F	<i>Egretta thula</i>	Snowy Egret	Wading	SNEG	0	2																					
6/1/2008	1	TLJ/F	4	F	<i>Tachycineta bicolor</i>	Tree Swallow	Passerine	TRSW	0	2																					
6/1/2008	1	TLJ/F	4	F	<i>Catoptrophorus semipalmatus</i>	Willet	Shorebird	WILL	1	0																					
6/1/2008	1	TLJ/F	4-5	WV	<i>Pandion haliaetus</i>	Osprey	Other	OSPR	0	1																					
6/1/2008	1	TLJ/F	4-5	WV	<i>Ammodramus maritimus</i>	Seaside Sparrow	Passerine	SESP	3	0	3																				
6/1/2008	1	TLJ/F	5	F	<i>Anas platyrhynchos</i>	Mallard	Waterfowl	MALL	2	0																					
6/1/2008	1	TLJ/F	5	F	<i>Cistothorus palustris</i>	Marsh Wren	Passerine	MAWR	5	0							5														
6/1/2008	1	TLJ/F	5	F	<i>Cyanus olor</i>	Mute Swan	Waterfowl	MUSV	1	0																					
6/1/2008	1	TLJ/F	5	F	<i>Agelaius phoeniceus</i>	Red-Winged Blackbird	Passerine	RWBL	1	0																					
6/1/2008	1	TLJ/F	5	F	<i>Ammodramus maritimus</i>	Seaside Sparrow	Passerine	SESP	1	0																					
6/1/2008	1	TLJ/F	5	F	<i>Charadrius semipalmatus</i>	Semipalmated Plover	Shorebird	SEPL	1	0																					
6/1/2008	1	TLJ/F	5	F	<i>Egretta thula</i>	Snowy Egret	Wading	SNEG	2	0																					
6/1/2008	1	TLJ/F	5	F	<i>Tachycineta bicolor</i>	Tree Swallow	Passerine	TRSW	0	0																					
7/23/2008	1	TLJ/F	0-1	WV	none				0	0																					
7/23/2008	1	TLJ/F	1	F	<i>Corvus brachyrhynchos</i>	American Crow	Passerine	AMCR	6	0																					
7/23/2008	1	TLJ/F	1	F	<i>Carduelis tristis</i>	American Goldfinch	Passerine	AMGO	2	0																					
7/23/2008	1	TLJ/F	1	F	<i>Quiscalus quiscula</i>	Common Grackle	Passerine	COGR	2	0																					
7/23/2008	1	TLJ/F	1	F	<i>Sterna antillarum</i>	Least Tern	Shorebird	LETE	1	0																					
7/23/2008	1	TLJ/F	1	F	<i>Cistothorus palustris</i>	Marsh Wren	Passerine	MAWR	4	0																					
7/23/2008	1	TLJ/F	1	F	<i>Agelaius phoeniceus</i>	Red-Winged Blackbird	Passerine	RWBL	8	0																					
7/23/2008	1	TLJ/F	1	F	<i>Ammodramus caudatus</i>	Saltmarsh Sharp-Tailed Sparrow	Passerine	SSTS	1	0																					
7/23/2008	1	TLJ/F	1	F	<i>Egretta thula</i>	Snowy Egret	Wading	SNEG	0	1																					
7/23/2008	1																														

Wertheim NWR Water Management Demonstration Project Data Report

Bird Survey  
2008

Date	Area	Observer	Point	Fixed Pt Walking	Species Scientific	Species Common	Guild	Alpha Code	Total Count (Excl. Fly)	Total Fly Over	0-50 meters			50-100 meters			>100 meters			Fly Over	
											0-3 min	3-5 min	5-10 min	0-3 min	3-5 min	5-10 min	0-3 min	3-5 min	5-10 min	0-10 min	0-10 min
7/23/2008	1	TI/JF	2	F	<i>Pandion haliaetus</i>	Osprey	Other	OSPR	0	1											1
7/23/2008	1	TI/JF	2	F	<i>Agelaius phoeniceus</i>	Red-Winged Blackbird	Passerine	RWBL	14	0					14						
7/23/2008	1	TI/JF	2	F	<i>Catoptrophorus semipalmatus</i>	Willet	Shorebird	WILL	1	0		1									
7/23/2008	1	TI/JF	2-3	WV	<i>Cistothorus palustris</i>	Marsh Wren	Passerine	MAWR	1	0		1									
7/23/2008	1	TI/JF	2-3	WV	<i>Ammodramus maritimus</i>	Saltmarsh Sharp-Tailed Sparrow	Passerine	SSTS	1	0	1										
7/23/2008	1	TI/JF	3	F	<i>Cistothorus palustris</i>	Marsh Wren	Passerine	MAWR	3	0					3						
7/23/2008	1	TI/JF	3	F	<i>Pandion haliaetus</i>	Osprey	Other	OSPR	2	0			2								
7/23/2008	1	TI/JF	3	F	<i>Agelaius phoeniceus</i>	Red-Winged Blackbird	Passerine	RWBL	5	0											
7/23/2008	1	TI/JF	3	F	<i>Ammodramus maritimus</i>	Saltmarsh Sharp-Tailed Sparrow	Passerine	SSTS	1	0		1				5					
7/23/2008	1	TI/JF	3	F	<i>Calidris pusilla</i>	Semipalmated Sandpiper	Shorebird	SESA	5	0			5								
7/23/2008	1	TI/JF	3	F	<i>Catoptrophorus semipalmatus</i>	Willet	Shorebird	WILL	1	0				1							
7/23/2008	1	TI/JF	3-4	WV	none				0	0											
7/23/2008	1	TI/JF	4	F	<i>Hirundo rustica</i>	Barn Swallow	Passerine	BARS	0	1											1
7/23/2008	1	TI/JF	4	F	<i>Calidris minutilla</i>	Least Sandpiper	Shorebird	LESA	2	0	2										
7/23/2008	1	TI/JF	4	F	<i>Cistothorus palustris</i>	Marsh Wren	Passerine	MAWR	2	0			2								
7/23/2008	1	TI/JF	4	F	<i>Calidris pusilla</i>	Semipalmated Sandpiper	Shorebird	SESA	2	0	2										
7/23/2008	1	TI/JF	4-5	WV	none				0	0											
7/23/2008	1	TI/JF	5	F	<i>Hirundo rustica</i>	Barn Swallow	Passerine	BARS	0	1											1
7/23/2008	1	TI/JF	5	F	<i>Ardea alba</i>	Great Egret	Wading	GREG	1	0	1										
7/23/2008	1	TI/JF	5	F	<i>Cistothorus palustris</i>	Marsh Wren	Passerine	MAWR	1	0		1									
7/23/2008	1	TI/JF	5	F	<i>Pandion haliaetus</i>	Osprey	Other	OSPR	0	2											2
7/23/2008	1	TI/JF	5	F	<i>Agelaius phoeniceus</i>	Red-Winged Blackbird	Passerine	RWBL	5	0			2				3				
7/23/2008	1	TI/JF	5	F	<i>Ammodramus maritimus</i>	Saltmarsh Sharp-Tailed Sparrow	Passerine	SSTS	3	0		3									
7/23/2008	1	TI/JF	5	F	<i>Tachycineta bicolor</i>	Tree Swallow	Passerine	TRSW	0	1											1
9/4/2008	1	TI/JF	0-1	WV	none				0	0											
9/4/2008	1	TI/JF	1	F	<i>Corvus brachyrhynchos</i>	American Crow	Passerine	AMCR	0	1											1
9/4/2008	1	TI/JF	1	F	<i>Carduelis tristis</i>	American Goldfinch	Passerine	AMGO	1	0		1									
9/4/2008	1	TI/JF	1	F	<i>Larus argentatus</i>	Herring Gull	Shorebird	HERG	0	3											3
9/4/2008	1	TI/JF	1	F	<i>Anas platyrhynchos</i>	Mallard	Waterfowl	MALL	3	0	3										
9/4/2008	1	TI/JF	1	F	<i>Zenaidura macroura</i>	Mourning Dove	Passerine	MODO	0	3											3
9/4/2008	1	TI/JF	1	F	<i>Agelaius phoeniceus</i>	Red-Winged Blackbird	Passerine	RWBL	0	0			8								
9/4/2008	1	TI/JF	1	F	<i>Cistothorus palustris</i>	Marsh Wren	Passerine	SEWR	1	0			1								
9/4/2008	1	TI/JF	1	F	<i>Calidris pusilla</i>	Semipalmated Sandpiper	Shorebird	SESA	0	16											1
9/4/2008	1	TI/JF	1-2	WV	<i>Carduelis tristis</i>	American Goldfinch	Passerine	AMGO	3	0		3									15
9/4/2008	1	TI/JF	1-2	WV	<i>Zenaidura macroura</i>	Mourning Dove	Passerine	MODO	1	0	1										
9/4/2008	1	TI/JF	1-2	WV	<i>Pandion haliaetus</i>	Osprey	Other	OSPR	1	0		1									
9/4/2008	1	TI/JF	1-2	WV	<i>Ammodramus maritimus</i>	Seaside Sparrow	Passerine	SESP	1	0	1										
9/4/2008	1	TI/JF	2	F	<i>Corvus brachyrhynchos</i>	American Crow	Passerine	AMCR	0	0											
9/4/2008	1	TI/JF	2	F	<i>Larus argentatus</i>	Herring Gull	Shorebird	HERG	0	2											2
9/4/2008	1	TI/JF	2	F	<i>Zenaidura macroura</i>	Mourning Dove	Passerine	MODO	0	4											4
9/4/2008	1	TI/JF	2-3	WV	<i>Ardea alba</i>	Great Egret	Wading	GREG	1	0							1				
9/4/2008	1	TI/JF	3	F	<i>Botaurus lentiginosus</i>	American Bittern	Wading	AMBI	1	0	1										
9/4/2008	1	TI/JF	3	F	<i>Corvus brachyrhynchos</i>	American Crow	Passerine	AMCR	0	2											2
9/4/2008	1	TI/JF	3	F	<i>Ardea alba</i>	Great Egret	Wading	GREG	2	0					2						
9/4/2008	1	TI/JF	3	F	<i>Anas crecca</i>	Green-Winged Teal	Waterfowl	GWTE	3	12				3							12
9/4/2008	1	TI/JF	3	F	<i>Larus argentatus</i>	Herring Gull	Shorebird	HERG	0	1											1
9/4/2008	1	TI/JF	3	F	<i>Anas platyrhynchos</i>	Mallard	Waterfowl	MALL	6	0					6						
9/4/2008	1	TI/JF	3	F	<i>Cistothorus palustris</i>	Marsh Wren	Passerine	SEWR	3	0		3									
9/4/2008	1	TI/JF	3-4	WV	<i>Cistothorus palustris</i>	Marsh Wren	Passerine	SEWR	1	0	1										1
9/4/2008	1	TI/JF	4	F	<i>Corvus brachyrhynchos</i>	American Crow	Passerine	AMCR	0	1											1
9/4/2008	1	TI/JF	4	F	<i>Sturnus vulgaris</i>	European Starling	Passerine	EUST	0	1											1
9/4/2008	1	TI/JF	4	F	<i>Ardea alba</i>	Great Egret	Wading	GREG	5	0				5							
9/4/2008	1	TI/JF	4	F	<i>Tringa melanoleuca</i>	Greater Yellowlegs	Shorebird	GRYE	1	0	1										
9/4/2008	1	TI/JF	4	F	<i>Larus argentatus</i>	Herring Gull	Shorebird	HERG	0	1											1
9/4/2008	1	TI/JF	4	F	<i>Zenaidura macroura</i>	Mourning Dove	Passerine	MODO	0	1											1
9/4/2008	1	TI/JF	4-5	WV	none				0	0											
9/4/2008	1	TI/JF	5	F	<i>Tringa melanoleuca</i>	Greater Yellowlegs	Shorebird	GRYE	1	0			1								
9/4/2008	1	TI/JF	5	F	<i>Calidris minutilla</i>	Least Sandpiper	Shorebird	LESA	2	0	2										
9/4/2008	1	TI/JF	5	F	<i>Egretta thula</i>	Snowy Egret	Wading	SNEG	7	0	7										

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Date	Area	Observer	Point	Fixed Pt Walking	Species Scientific	Species Common	Guild	Alpha Code	Total Count (Excl. Fly)	Total Fly Over	0-50 meters			50-100 meters			>100 meters			Fly Over	
											0-3 min	3-5 min	5-10 min	0-3 min	3-5 min	5-10 min	0-3 min	3-5 min	5-10 min	0-10 min	0-10 min
											s h s/h	s h s/h	s h s/h	s h s/h	s h s/h	s h s/h	s h s/h	s h s/h	s h s/h	s h s/h	s h s/h
2/21/2008	2	TI/JF	1	F	<i>Sturnella magna</i>	Eastern Meadowlark	Passerine	EAME	1	0	1										
2/21/2008	2	TI/JF	1-2	W	none				0	0											
2/21/2008	2	TI/JF	2	F	none				0	0											
2/21/2008	2	TI/JF	2-3	W	none				0	0											
2/21/2008	2	TI/JF	3	F	<i>Circus cyaneus</i>	Northern Harrier	Other	NOHA	2	0	2										
2/21/2008	2	TI/JF	3	F	<i>Larus argentatus</i>	Herring Gull	Shorebird	HERG	0	13											13
2/21/2008	2	TI/JF	3-4	W	none				0	0											
2/21/2008	2	TI/JF	4	F	Unidentified sparrow	Unknown Sparrow	Passerine	UNSP	3	0	2				1						
2/21/2008	2	TI/JF	4-5	W	none				0	0											
2/21/2008	2	TI/JF	5	F	Unidentified sparrow	Unknown Sparrow	Passerine	UNSP	1	0					1						
6/19/2008	2	TI/JF	0-1	W	none				0	0											
6/19/2008	2	TI/JF	1	F	<i>Hirundo rustica</i>	Barn Swallow	Passerine	BARS	1	0	1										
6/19/2008	2	TI/JF	1	F	<i>Agelaius phoeniceus</i>	Red-Winged Blackbird	Passerine	RWBL	1	0					1						
6/19/2008	2	TI/JF	1	F	<i>Ammodramus caudatus</i>	Saltmarsh Sharp-Tailed Sparrow	Passerine	SSTS	5	0	2										
6/19/2008	2	TI/JF	1	F	<i>Ammodramus maritimus</i>	Seaside Sparrow	Passerine	SESP	1	0			1								
6/19/2008	2	TI/JF	1	F	<i>Tachycineta bicolor</i>	Tree Swallow	Passerine	TRSW	1	0						1					
6/19/2008	2	TI/JF	1	F	<i>Catoptrophorus semipalmatus</i>	Willet	Shorebird	WILL	3	0							2				
6/19/2008	2	TI/JF	1-2	W	none				0	0			1								
6/19/2008	2	TI/JF	2	F	<i>Cistothorus palustris</i>	Marsh Wren	Passerine	MAWR	2	0				2							
6/19/2008	2	TI/JF	2	F	<i>Agelaius phoeniceus</i>	Red-Winged Blackbird	Passerine	RWBL	1	0			1								
6/19/2008	2	TI/JF	2	F	<i>Ammodramus caudatus</i>	Saltmarsh Sharp-Tailed Sparrow	Passerine	SSTS	4	0	1		3								
6/19/2008	2	TI/JF	2	F	<i>Tachycineta bicolor</i>	Tree Swallow	Passerine	TRSW	0	3											3
6/19/2008	2	TI/JF	2-3	W	none				0	0											
6/19/2008	2	TI/JF	3	F	<i>Corvus brachyrhynchos</i>	American Crow	Passerine	AMCR	2	0					2						
6/19/2008	2	TI/JF	3	F	<i>Cistothorus palustris</i>	Marsh Wren	Passerine	MAWR	8	0		8									
6/19/2008	2	TI/JF	3	F	<i>Ammodramus caudatus</i>	Saltmarsh Sharp-Tailed Sparrow	Passerine	SSTS	2	0			2								
6/19/2008	2	TI/JF	3	F	<i>Ammodramus maritimus</i>	Seaside Sparrow	Passerine	SESP	1	0			1								
6/19/2008	2	TI/JF	3	F	<i>Tachycineta bicolor</i>	Tree Swallow	Passerine	TRSW	1	0	1										
6/19/2008	2	TI/JF	3-4	W	none				0	0											
6/19/2008	2	TI/JF	4	F	<i>Hirundo rustica</i>	Barn Swallow	Passerine	BARS	2	0			2								
6/19/2008	2	TI/JF	4	F	<i>Cistothorus palustris</i>	Marsh Wren	Passerine	MAWR	6	0	6										
6/19/2008	2	TI/JF	4	F	<i>Agelaius phoeniceus</i>	Red-Winged Blackbird	Passerine	RWBL	1	0			1								
6/19/2008	2	TI/JF	4	F	<i>Ammodramus caudatus</i>	Saltmarsh Sharp-Tailed Sparrow	Passerine	SSTS	2	0	2										
6/19/2008	2	TI/JF	4	F	<i>Ammodramus maritimus</i>	Seaside Sparrow	Passerine	SESP	3	0	3										
6/19/2008	2	TI/JF	4	F	<i>Tachycineta bicolor</i>	Tree Swallow	Passerine	TRSW	3	0	3										
6/19/2008	2	TI/JF	4-5	W	none				0	0											
6/19/2008	2	TI/JF	5	F	<i>Cistothorus palustris</i>	Marsh Wren	Passerine	MAWR	6	0		6									
6/19/2008	2	TI/JF	5	F	<i>Agelaius phoeniceus</i>	Red-Winged Blackbird	Passerine	RWBL	3	0		1									1
6/19/2008	2	TI/JF	5	F	<i>Ammodramus caudatus</i>	Saltmarsh Sharp-Tailed Sparrow	Passerine	SSTS	3	0			3								
6/19/2008	2	TI/JF	5	F	<i>Ammodramus maritimus</i>	Seaside Sparrow	Passerine	SESP	2	0			2								
6/19/2008	2	TI/JF	5	F	<i>Tachycineta bicolor</i>	Tree Swallow	Passerine	TRSW	2	0	2										
7/25/2008	2	TI/JF	0-1	W	none				0	0											
7/25/2008	2	TI/JF	1	F	<i>Cistothorus palustris</i>	Marsh Wren	Passerine	MAWR	3	0		2		1							
7/25/2008	2	TI/JF	1	F	<i>Pandion haliaetus</i>	Osprey	Other	OSPR	0	1											1
7/25/2008	2	TI/JF	1	F	<i>Ammodramus maritimus</i>	Seaside Sparrow	Passerine	SESP	3	0	2			1							
7/25/2008	2	TI/JF	1	F	<i>Catoptrophorus semipalmatus</i>	Willet	Shorebird	WILL	1	0	1										
7/25/2008	2	TI/JF	1-2	W	none				0	0											
7/25/2008	2	TI/JF	2	F	<i>Sterna forsteri</i>	Fosters Tern	Shorebird	FOTE	0	1											1
7/25/2008	2	TI/JF	2	F	<i>Ardea alba</i>	Great Egret	Wading	GREG	0	1											1
7/25/2008	2	TI/JF	2	F	<i>Larus atricilla</i>	Laughing Gull	Shorebird	LAGU	0	1											1
7/25/2008	2	TI/JF	2	F	<i>Cistothorus palustris</i>	Marsh Wren	Passerine	MAWR	3	0		3									
7/25/2008	2	TI/JF	2	F	<i>Pandion haliaetus</i>	Osprey	Other	OSPR	0	1											1
7/25/2008	2	TI/JF	2	F	<i>Ammodramus maritimus</i>	Seaside Sparrow	Passerine	SESP	2	0	2										
7/25/2008	2	TI/JF	2	F	<i>Catoptrophorus semipalmatus</i>	Willet	Shorebird	WILL	0	0											
7/25/2008	2	TI/JF	2-3	W	none				0	0											
7/25/2008	2	TI/JF	3	F	<i>Larus argentatus</i>	Herring Gull	Shorebird	HERG	0	3											3
7/25/2008	2	TI/JF	3	F	<i>Cistothorus palustris</i>	Marsh Wren	Passerine	MAWR	5	0		5									
7/25/2008	2	TI/JF	3	F	<i>Agelaius phoeniceus</i>	Red-Winged Blackbird	Passerine	RWBL	2	0		2									
7/25/2008	2	TI/JF	3	F	<i>Catoptrophorus semipalmatus</i>	Willet	Shorebird	WILL	2	2			1	1							2
7/25/2008	2	TI/JF	3-4	W	none				0	0											
7/25/2008	2	TI/JF	4	F	<i>Calidris minutilla</i>	Least Sandpiper	Shorebird	LESA	1	0	1										
7/25/2008	2	TI/JF	4	F	<i>Cistothorus palustris</i>	Marsh Wren	Passerine	MAWR	7	0			7								
7/25/2008	2	TI/JF	4	F	<i>Pandion haliaetus</i>	Osprey	Other	OSPR	0	0											
7/25/2008	2	TI/JF	4	F	<i>Ammodramus maritimus</i>	Seaside Sparrow	Passerine	SESP	1	0			1								
7/25/2008	2	TI/JF	4	F	<i>Ammodramus caudatus</i>	Sharp-Tailed Sparrow	Passerine	STSP	1	0			1								
7/25/2008	2	TI/JF	4	F	<i>Catoptrophorus semipalmatus</i>	Willet	Shorebird	WILL	1	0			1								
7/25/2008	2	TI/JF	4-5	W	none				0	0											
7/25/2008	2	TI/JF	5	F	<i>Hirundo rustica</i>	Barn Swallow	Passerine	BARS	0	1											1
7/25/2008	2	TI/JF	5	F	<i>Sterna forsteri</i>	Fosters Tern	Shorebird	FOTE	0	2											2
7/25/2008	2	TI/JF	5	F	<i>Calidris minutilla</i>	Least Sandpiper	Shorebird	LESA	2	0	1			1							
7/25/2008	2	TI/JF	5	F	<i>Cistothorus palustris</i>	Marsh Wren	Passerine	MAWR	2	0			2								
7/25/2008	2	TI/JF	5	F	<i>Zenaidura macroura</i>	Mourning Dove	Passerine	MODO	1	0			1								
7/25/2008	2	TI/JF	5	F	<i>Ammodramus maritimus</i>	Seaside Sparrow	Passerine	SESP	1	0	1										
7/25/2008	2	TI/JF	5	F	<i>Egretta thula</i>	Snowy Egret	Wading	SNEG	1	0			1								

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Date	Area	Observer	Point	Fixed Pt Walking	Species Scientific	Species Common	Guild	Alpha Code	Total Count (Excl. Fly)	Total Fly Over	0-50 meters			50-100 meters			>100 meters			Fly Over	
											0-3 min	3-5 min	5-10 min	0-3 min	3-5 min	5-10 min	0-3 min	3-5 min	5-10 min	0-3 min	0-10 min
											s	h	s/h	s	h	s/h	s	h	s/h	s	h
7/25/2008	2	TI/JF	5	F	<i>Catoptrophorus semipalmatus</i>	Willet	Shorebird	WILL	4	0											
9/5/2008	2	TI/JF	0-1	WV	none				0	0											
9/5/2008	2	TI/JF	1	F	<i>Anas crecca</i>	Green-Winged Teal	Waterfowl	GWTE	1	0	1										
9/5/2008	2	TI/JF	1	F	<i>Larus argentatus</i>	Herring Gull	Shorebird	HERG	0	1											1
9/5/2008	2	TI/JF	1	F	<i>Calidris minutilla</i>	Least Sandpiper	Shorebird	LESA	0	1											1
9/5/2008	2	TI/JF	1	F	<i>Calidris pusilla</i>	Semipalmated Sandpiper	Shorebird	SESA	3	0											
9/5/2008	2	TI/JF	1	F	<i>Egretta thula</i>	Snowy Egret	Wading	SNEG	0	0											
9/5/2008	2	TI/JF	1	F	<i>Catoptrophorus semipalmatus</i>	Willet	Shorebird	WILL	1	0				5		3					
9/5/2008	2	TI/JF	1-2	WV	none				0	0					1						
9/5/2008	2	TI/JF	2	F	<i>Corvus brachyrhynchos</i>	American Crow	Passerine	AMCR	3	0				3							
9/5/2008	2	TI/JF	2-3	WV	none				0	0											
9/5/2008	2	TI/JF	3	F	<i>Corvus brachyrhynchos</i>	American Crow	Passerine	AMCR	1	0				1							
9/5/2008	2	TI/JF	3	F	<i>Anas discors</i>	Blue-Winged Teal	Waterfowl	BWTE	1	0	1										
9/5/2008	2	TI/JF	3	F	<i>Ardea herodias</i>	Great Blue Heron	Wading	GTBH	1	0					1						
9/5/2008	2	TI/JF	3	F	<i>Anas crecca</i>	Green-Winged Teal	Waterfowl	GWTE	58	0	58										
9/5/2008	2	TI/JF	3	F	<i>Larus argentatus</i>	Herring Gull	Shorebird	HERG	1	0						1					
9/5/2008	2	TI/JF	3	F	<i>Anas platyrhynchos</i>	Mallard	Waterfowl	MALL	11	0	11										
9/5/2008	2	TI/JF	3-4	WV	none				0	0											
9/5/2008	2	TI/JF	4	F	<i>Anas crecca</i>	Green-Winged Teal	Waterfowl	GWTE	12	0						12					
9/5/2008	2	TI/JF	4	F	<i>Larus argentatus</i>	Herring Gull	Shorebird	HERG	0	1											1
9/5/2008	2	TI/JF	4	F	<i>Calidris minutilla</i>	Least Sandpiper	Shorebird	LESA	0	3											3
9/5/2008	2	TI/JF	4	F	<i>Archilochus colubris</i>	Ruby-Throated Hummingbird	Passerine	RTHU	0	1											1
9/5/2008	2	TI/JF	4	F	<i>Cistothorus palustris</i>	Marsh Wren	Passerine	SEWR	1	0				1							
9/5/2008	2	TI/JF	4	F	<i>Egretta thula</i>	Snowy Egret	Wading	SNEG	1	0	1										
9/5/2008	2	TI/JF	4	F	<i>Catoptrophorus semipalmatus</i>	Willet	Shorebird	WILL	1	0	1										
9/5/2008	2	TI/JF	4-5	WV	none				0	0											
9/5/2008	2	TI/JF	5	F	<i>Anas discors</i>	Blue-Winged Teal	Waterfowl	BWTE	0	1											1
9/5/2008	2	TI/JF	5	F	<i>Anas crecca</i>	Green-Winged Teal	Waterfowl	GWTE	0	28											28
9/5/2008	2	TI/JF	5	F	<i>Larus argentatus</i>	Herring Gull	Shorebird	HERG	0	1											1
9/5/2008	2	TI/JF	5	F	<i>Anas platyrhynchos</i>	Mallard	Waterfowl	MALL	0	1											1
9/5/2008	2	TI/JF	5	F	<i>Egretta thula</i>	Snowy Egret	Wading	SNEG	3	0	3										
9/5/2008	2	TI/JF	5	F	<i>Tachycineta bicolor</i>	Tree Swallow	Passerine	TRSW	0	2											2

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Date	Area	Observer	Point	Fixed Pt Walking	Species Scientific	Species Common	Guild	Alpha Code	Total Count (Excl. Fly)	Total Fly Over	0-50 meters			50-100 meters			>100 meters			Fly Over	
											0-3 min s h s/h	3-5 min s h s/h	5-10 min s h s/h	0-3 min s h s/h	3-5 min s h s/h	5-10 min s h s/h	0-3 min s h s/h	3-5 min s h s/h	5-10 min s h s/h	0-10 min s h s/h	0-10 min s h s/h
2/21/2008	4	TIJF	0-1	VW	none				0	0											
2/21/2008	4	TIJF	1	F	<i>Agelaius phoeniceus</i>	Red-Winged Blackbird	Passerine	RWBL	1	0				1							
2/21/2008	4	TIJF	1-2	VW	none				0	0											
2/21/2008	4	TIJF	2	F	<i>Agelaius phoeniceus</i>	Red-Winged Blackbird	Passerine	RWBL	115	0					15				100		
2/21/2008	4	TIJF	2	F	<i>Sturnella magna</i>	Eastern Meadowlark	Passerine	EAME	10	0				10							
2/21/2008	4	TIJF	2	F	<i>Anas rubripes</i>	American Black Duck	Waterfowl	ABDU	9	0						8					
2/21/2008	4	TIJF	2-3	VW	none				0	0											
2/21/2008	4	TIJF	3	F	<i>Circus cyaneus</i>	Northern Harrier	Other	NOHA	1	0	1										
2/21/2008	4	TIJF	3-4	VW	none				0	0											
2/21/2008	4	TIJF	4	F	<i>Sturnella magna</i>	Eastern Meadowlark	Passerine	EAME	1	0	1										
2/21/2008	4	TIJF	4	F	Unidentified sparrow	Unknown Sparrow	Passerine	UNSP	5	0	4		1								
6/18/2008	4	TIJF	0-1	VW	<i>Catoptrophorus semipalmatus</i>	Willet	Shorebird	WILL	2	0		2									
6/18/2008	4	TIJF	1	F	<i>Anas rubripes</i>	American Black Duck	Waterfowl	ABDU	1	0				1							
6/18/2008	4	TIJF	1	F	<i>Hirundo rustica</i>	Barn Swallow	Passerine	BARS	3	0			3								
6/18/2008	4	TIJF	1	F	<i>Sturnus vulgaris</i>	European Starling	Passerine	EUST	1	0		1									
6/18/2008	4	TIJF	1	F	<i>Agelaius phoeniceus</i>	Red-Winged Blackbird	Passerine	RWBL	3	0		3									
6/18/2008	4	TIJF	1	F	<i>Tachycineta bicolor</i>	Tree Swallow	Passerine	TRSW	1	0				1							
6/18/2008	4	TIJF	1	F	Unidentified sparrow	Unknown Sparrow	Passerine	UNSP	1	0					1						
6/18/2008	4	TIJF	1	F	<i>Catoptrophorus semipalmatus</i>	Willet	Shorebird	WILL	3	0		3									
6/18/2008	4	TIJF	1-2	VW	none				0	0											
6/18/2008	4	TIJF	2	F	<i>Nycticorax nycticorax</i>	Black Crowned Night-Heron	Wading	BCNH	2	0	2										
6/18/2008	4	TIJF	2	F	<i>Cistothorus palustris</i>	Marsh Wren	Passerine	MAWR	2	0		2									
6/18/2008	4	TIJF	2	F	<i>Ammodramus maritimus</i>	Seaside Sparrow	Passerine	SESP	2	0			2								
6/18/2008	4	TIJF	2	F	<i>Catoptrophorus semipalmatus</i>	Willet	Shorebird	WILL	1	0					1						
6/18/2008	4	TIJF	2-3	VW	<i>Cistothorus palustris</i>	Marsh Wren	Passerine	MAWR	1	0		1									
6/18/2008	4	TIJF	2-3	VW	<i>Egretta thula</i>	Snowy Egret	Wading	SNEG	1	0	1										
6/18/2008	4	TIJF	2-3	VW	<i>Catoptrophorus semipalmatus</i>	Willet	Shorebird	WILL	1	0		1									
6/18/2008	4	TIJF	3	F	<i>Corvus brachyrhynchos</i>	American Crow	Passerine	AMCR	1	0			1								
6/18/2008	4	TIJF	3	F	<i>Hirundo rustica</i>	Barn Swallow	Passerine	BARS	3	0	3										
6/18/2008	4	TIJF	3	F	<i>Ardea alba</i>	Great Egret	Wading	GREG	1	0			1								
6/18/2008	4	TIJF	3	F	<i>Cistothorus palustris</i>	Marsh Wren	Passerine	MAWR	4	0		4									
6/18/2008	4	TIJF	3	F	<i>Catoptrophorus semipalmatus</i>	Willet	Shorebird	WILL	2	0		2									
6/18/2008	4	TIJF	3-4	VW	none				0	0											
6/18/2008	4	TIJF	4	F	<i>Hirundo rustica</i>	Barn Swallow	Passerine	BARS	0	1											1
6/18/2008	4	TIJF	4	F	<i>Bombus terrestris</i>	Cedar Waxing	Passerine	CEDW	4	0							4				
6/18/2008	4	TIJF	4	F	<i>Sturnus vulgaris</i>	European Starling	Passerine	EUST	4	0			4								
6/18/2008	4	TIJF	4	F	<i>Eudocimus albus</i>	Glossy Ibis	Wading	GLIB	1	0				1							
6/18/2008	4	TIJF	4	F	<i>Zenaidura macroura</i>	Mourning Dove	Passerine	MODO	0	1											
6/18/2008	4	TIJF	4	F	<i>Agelaius phoeniceus</i>	Red-Winged Blackbird	Passerine	RWBL	1	1										1	1
6/18/2008	4	TIJF	4	F	<i>Tachycineta bicolor</i>	Tree Swallow	Passerine	TRSW	1	0											
6/18/2008	4	TIJF	4	F	<i>Catoptrophorus semipalmatus</i>	Willet	Shorebird	WILL	2	0				2							
7/28/2008	4	TIJF	0-1	VW	none				0	0											
7/28/2008	4	TIJF	1	F	<i>Hirundo rustica</i>	Barn Swallow	Passerine	BARS	0	8											8
7/28/2008	4	TIJF	1	F	<i>Cistothorus palustris</i>	Marsh Wren	Passerine	MAWR	1	0			1								
7/28/2008	4	TIJF	1	F	<i>Tachycineta bicolor</i>	Tree Swallow	Passerine	TRSW	0	1											1
7/28/2008	4	TIJF	1	F	<i>Catoptrophorus semipalmatus</i>	Willet	Shorebird	WILL	1	0						1					
7/28/2008	4	TIJF	1-2	VW	none				0	0											
7/28/2008	4	TIJF	2	F	<i>Hirundo rustica</i>	Barn Swallow	Passerine	BARS	0	3											3
7/28/2008	4	TIJF	2	F	<i>Cistothorus palustris</i>	Marsh Wren	Passerine	MAWR	2	0		2									
7/28/2008	4	TIJF	2	F	<i>Ammodramus maritimus</i>	Seaside Sparrow	Passerine	SESP	1	0		1									
7/28/2008	4	TIJF	2-3	VW	none				0	0											
7/28/2008	4	TIJF	3	F	<i>Branta canadensis</i>	Canada Goose	Waterfowl	CAGO	2	0							2				
7/28/2008	4	TIJF	3	F	<i>Larus marinus</i>	Great Black-Backed Gull	Shorebird	GBBG	3	0									3		
7/28/2008	4	TIJF	3-4	VW	none				0	0			2								
7/28/2008	4	TIJF	4	F	<i>Hirundo rustica</i>	Barn Swallow	Passerine	BARS	0	12											12
7/28/2008	4	TIJF	4	F	<i>Zenaidura macroura</i>	Mourning Dove	Passerine	MODO	3	0			3								
7/28/2008	4	TIJF	4	F	<i>Agelaius phoeniceus</i>	Red-Winged Blackbird	Passerine	RWBL	3	0			3								
7/28/2008	4	TIJF	4	F	<i>Ammodramus maritimus</i>	Seaside Sparrow	Passerine	SESP	2	0	2										
7/28/2008	4	TIJF	4	F	<i>Ammodramus caudatus</i>	Sharp-Tailed Sparrow	Passerine	STSP	1	0			1								
7/28/2008	4	TIJF	4	F	<i>Tachycineta bicolor</i>	Tree Swallow	Passerine	TRSW	0	1											1
9/4/2008	4	TIJF	0-1	VW	none				0	0											
9/4/2008	4	TIJF	1	F	<i>Cyanocitta cristata</i>	Blue Jay	Passerine	BLJA	2	0						2					
9/4/2008	4	TIJF	1	F	<i>Ardea alba</i>	Great Egret	Wading	GREG	4	2											2
9/4/2008	4	TIJF	1	F	<i>Calcarius maritimus</i>	Least Sandpiper	Shorebird	LESA	0	0											
9/4/2008	4	TIJF	1-2	VW	<i>Calcarius maritimus</i>	Least Sandpiper	Shorebird	LESA	2	0		2									
9/4/2008	4	TIJF	1-2	VW	<i>Ammodramus caudatus</i>	Saltmarsh Sharp-Tailed Sparrow	Passerine	SSTS	2	0		2									
9/4/2008	4	TIJF	2	F	<i>Zenaidura macroura</i>	Mourning Dove	Passerine	MODO	0	1											1
9/4/2008	4	TIJF	2	F	<i>Ammodramus caudatus</i>	Saltmarsh Sharp-Tailed Sparrow	Passerine	SSTS	1	0	1										
9/4/2008	4	TIJF	2	F	<i>Tachycineta bicolor</i>	Tree Swallow	Passerine	TRSW	0	30											30
9/4/2008	4	TIJF	2-3	VW	<i>Anas platyrhynchos</i>	Mallard	Waterfowl	MALL	0	1											1
9/4/2008	4	TIJF	2-3	VW	<i>Ammodramus caudatus</i>	Saltmarsh Sharp-Tailed Sparrow	Passerine	SSTS	0	1											1
9/4/2008	4	TIJF	3	F	<i>Phalacrocorax spp</i>	Common Loon	Waterfowl	UNCO	0	1											1
9/4/2008	4	TIJF	3	F	<i>Zenaidura macroura</i>	Mourning Dove	Passerine	MODO	0	1											1



Wertheim NWR Water Management Demonstration Project Data Report  
Bird Survey  
2008

Date	Area	Observer	Point	Fixed Pt Walking	Species Scientific	Species Common	Guild	Alpha Code	Total Count (Excl. Fly)	Total Fly Over	0-50 meters			50-100 meters			>100 meters			Fly Over	
											0-3 min	3-5min	5-10 min	0-3 min	3-5min	5-10 min	0-3 min	3-5min	5-10 min	0-10 min	
											s h s/h	s h s/h	s h s/h	s h s/h	s h s/h	s h s/h	s h s/h	s h s/h	s h s/h	s h s/h	s h s/h
9/4/2008	4	TI/JF	3	F	<i>Cistothorus palustris</i>	Marsh Wren	Passerine	SEVR	1	0			1								
9/4/2008	4	TI/JF	3-4	W	<i>Zenaidura macroura</i>	Mourning Dove	Passerine	MODO	0	1											1
9/4/2008	4	TI/JF	4	F	<i>Egretta thula</i>	Snowy Egret	Wading	SNEG	1	0				1							
9/4/2008	4	TI/JF	4	F	<i>Unidentified heron</i>	Unknown Heron	Wading	UNHE	0	1											1